

**Bio-logic Systems Corp
Auditory Evoked Potential (AEP)
System
(Including Electroneuronography,
Stacked ABR, CHAMP & BioMAP)**

User's and Service Manual

590-AEPUM1; Rev E

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Safety and Proper Use Information



WARNING

Never turn power on or off with a patient connected to the system. Only qualified personnel should use this device. Please read this section before installing any of the hardware. Refer to this section when you operate, transport, store, or re-install the system.

AVERTISSEMENT

Ne jamais mettre le système sous tension ou hors tension pendant qu'un patient y est branché. Ce dispositif ne doit être utilisé que par un personnel qualifié. Veuillez lire la présente section avant de commencer l'installation du matériel. Consulter la présente section pour des informations sur le fonctionnement, le transport, le rangement ou la réinstallation du système.



WARNING

All of the disposable supplies from Bio-logic Systems Corp that are coupled to the scalp are latex-free and comprised of hypoallergenic material. Bio-logic is not responsible for disposable items purchased from another vendor. Carefully read and follow the proper use instructions that accompany any disposable items.

AVERTISSEMENT

Tous les produits jetables destinés à entrer en contact avec le cuir chevelu fournis par Bio-logic Systems Corp. sont fabriqués de matières hypoallergéniques et ne contiennent pas de latex. Bio-logic n'assume aucune responsabilité à l'égard des articles jetables achetés d'un autre fournisseur. Lire et appliquer minutieusement les directives d'utilisation correcte qui accompagnent tout produit jetable.



WARNING

Make sure that any platform, table, cart, or other surface used during the operation, transport, or temporary or permanent storage of the system and its components is adequate, sturdy, and safe. Bio-logic Systems Corp is not responsible for any injury or damage that may result from inadequate, poorly constructed, or unapproved transports, carts, operating surfaces

AVERTISSEMENT

Veiller à ce que toute surface utilisée pour le fonctionnement, le transport ou le rangement temporaire ou permanent du système ou de ses composants, notamment toute plateforme, toute table ou tout chariot, soit de dimensions suffisantes, robuste et sans danger. Bio-logic Systems Corp. n'assume aucune responsabilité à l'égard des blessures ou dégâts découlant de l'utilisation de dispositifs de transport, de chariots ou de surfaces d'opération inappropriés, mal construits ou non homologués.



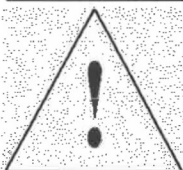
WARNING

Never use equipment that has parts missing or equipment that might contain loose parts inside of it (that is, inside an enclosed portion of the equipment). If you suspect a piece of equipment has missing or loose parts, make contact with Bio-logic System Corp.

AVERTISSEMENT

Ne jamais utiliser le matériel s'il manque de pièces ou s'il contient (dans une de ses structures fermées) des pièces desserrées. Si vous avez des raisons de croire à l'existence de pièces manquantes ou desserrées dans une des composantes du matériel, communiquez avec Bio-logic Systems Corp.

Safety and Proper Use Information



WARNING

Never place powered equipment (that is, equipment that operates with an electric power source) on any flammable surface. Avoid this whether the equipment is active or not.

AVERTISSEMENT

Ne jamais placer du matériel électrique, qu'il soit en marche ou non, sur une surface inflammable.

INTRODUCTION

AEP

The Auditory Evoked Potential (AEP) software program, when used with the Bio-logic Systems Corp Navigator Pro® unit, can perform the test procedures necessary to generate most Auditory Evoked Potentials. Operators can collect patient data, print test results, store the data in the Bio-logic Systems Corp Patient and Test Information (P&TI) database, and retrieve and review stored data.

AEP can be purchased with 1 or 2 channels and can be used with the following transducers: TDH-39, Bio-logic Insert earphones, Bio-logic Broadband Insert earphones (only for use with Stacked ABR & CHAMP), bone oscillator, or soundfield speakers. AEP comes standard with three stimulus options, click, toneburst or custom (use speech stimuli by using your own WAV files) and with ABR, ECochG, MLR, 40 Hz, and VEMP protocols.

Other optional features that can expand your AEP capabilities are:

- GraphMaster
- P300.
- Stacked ABR.
- Cochlear Hydrops Analysis Masking Procedure (CHAMP).

Stacked ABR

The Stacked Auditory Brainstem Response (ABR) is a modified ABR test that can be used to screen for the presence of auditory nervous system abnormalities. The test can also reduce the number of people sent for MRIs who do not have auditory nervous system abnormalities.

Note: Stacked ABR requires precise measurements for electrode application and other patient preparation procedures to obtain usable data. Advanced training is required at a Bio-logic Systems Corp sponsored practicum (www.acecenters.com). It is not recommended for those inexperienced in ABR data collection. Even experienced and expert standard ABR users should attend a practicum.

The Stacked ABR test may provide useful diagnostic information for patients with an auditory system abnormality. However, users should not perform the test when any of these conditions exist:

- Conductive or mixed hearing loss.
- Flat sensorineural hearing loss of 60 dB HL or greater.
- Residual hearing at only 250-750 Hz.
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.
- Hyperacusis.

Cochlear Hydrops Analysis Masking Procedure (CHAMP)

The Cochlear Hydrops Analysis Masking Procedure (CHAMP) test is a modified ABR test that can be used to screen for the presence of cochlear hydrops. Patients with Meniere's disease have the idiopathic syndrome of cochlear (endolymphatic) hydrops along with episodic vertigo, tinnitus, fluctuating hearing loss, and a sensation of aural fullness or pressure.

Note: CHAMP requires precise measurements for electrode application and other patient preparation procedures to obtain usable data. Advanced training is required at a Bio-logic Systems Corp sponsored practicum (www.acecenters.com). It is not recommended for those inexperienced in ABR data collection. Even experienced and expert standard ABR users should attend a practicum.

The CHAMP test may provide useful diagnostic information for patients with cochlear hydrops. However, users should not perform the test when any of these conditions exist:

- Conductive or mixed hearing loss.
- Flat sensorineural hearing loss of 70 dB HL or greater.
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.
- Hyperacusis.

BioMAP (Biological Marker of Auditory Processing)

The BioMAP (Biological Marker of Auditory Processing) is a neurophysiological test used to quickly and objectively identify disordered processing of sound that has been associated with learning impairments in many children. However, users should not perform the test when any of these conditions exist:

- Conductive, mixed, or sensorineural hearing loss (The audiogram should be recent. Do not assume that because immittance measures are normal that an air/bone gap does not exist. Perform bone conduction audiometry to verify that a conductive or mixed hearing loss is not present.)
- Abnormal waveform morphology on a standard click ABR
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.



CAUTION

The Navigator Pro is intended for use by a health care professional or a technician who is trained and supervised by a health care professional or accredited organization.

MISE EN GARDE

Le Navigator Pro est conçu pour être utilisé par un professionnel de la santé ou un technicien qualifié dirigé par un professionnel de la santé ou une organisation accréditée.

INSTALLATION

Installing the AEP system

As part of the purchase price for your AEP system, you are entitled to installation and one training session from your local Bio-logic Systems Corp representative. Contact your local representative when you receive your system to schedule installation and training. If you do not know your local representative, please phone our Customer Support Department at 1-800-272-8075 or 1-847-949-5200.



CAUTION

This system is intended for use as a medical instrument only. The software installed on this system has been verified and validated for that use, as long as no other unintended or unauthorized software is installed and running at the same time. Do not install, download, save, or transfer other programs, software, or data on this equipment without first consulting Bio-logic Systems Corp. Doing so may interfere with the proper operation of this software.

MISE EN GARDE

Cet appareil est conçu pour être utilisé comme instrument médical seulement. Le logiciel installé dans l'appareil a été vérifié et validé pour cette utilisation, pourvu qu'il n'y ait aucun autre logiciel non autorisé fonctionnant en même temps. Aucun téléchargement ou transfert ni aucune installation ou sauvegarde d'autres programmes, de logiciels ou de données ne doit être entrepris sur cet appareil sans avoir préalablement consulté Biologic Systems Corp. De telles opérations pourraient interférer avec le fonctionnement de ce logiciel.

Minimum Computer Specifications

Computer System	—IBM compatible computer (166 MHz or better) —A minimum of 256 MB dynamic RAM memory —1 GB Hard Disk —Available serial port or USB port
Operating System	—Windows 98 SE, 2000, XP Pro
Disk Drives	—CD-RW Drive —At least one mass storage device (hard drive) with a minimum of 500 MB free space.
UL Compliance	An isolation transformer if computer chassis leakage exceeds 100 microamps.
Printing Devices	Any Windows 98 SE, XP Pro compatible printer.
Other Hardware	Navigator Pro® EP unit and accessories.
Standards	IEC 60950 Information Technology Equipment

Software Installation

If you purchased a complete AEP system from Bio-logic, including the computer, then the software is already installed at the time of delivery. However, if you purchased a kit and are using it with a computer that you supplied through a separate purchase, your Bio-logic representative will install the software for you. Refer to the Minimum Computer Specifications section of this document and verify that your computer meets these minimum specifications. If it does not meet these requirements, your kit may not function properly.

Note: Bio-logic Systems Corp is not responsible for resolving incompatibilities between the kit and a computer that is provided by the customer or dealer.

Software Installation Policy

Bio-logic Systems Corp manufactures medical equipment that includes hardware and application software that is installed onto a standard computer. Bio-logic encourages the customer to purchase of these systems as a complete system, including the computer. The computer provided by Bio-logic is tested with all of our hardware and applications. The configuration of the operating system is optimized to avoid conflicts with the operation of Bio-logic applications. Bio-logic Systems Corp warrants the system for a period of one year and this warranty includes the Bio-logic-supplied computer. However, Bio-logic's warranty does not cover compatibility problems that can arise when the customer adds non-Bio-logic software or hardware to a Bio-logic supplied computer.

Some customers prefer to purchase the computer separately or to use an existing computer rather than purchasing the computer from Bio-logic. In most cases this works well. However, in some instances there are issues with the customer-supplied computer (hardware or operating system issues) that cause communication problems between Bio-logic's peripheral hardware and the computer. Bio-logic is not responsible for issues related to the compatibility of our hardware or software with a computer that is not supplied by Bio-logic.

Our Technical Support staff will provide one 15-minute session of telephone support at no charge to assist our authorized distributors or customers to try to troubleshoot these conflicts. Our Technical Support staff will not provide telephone support for these issues beyond one 15-minute session.

Hardware Installation



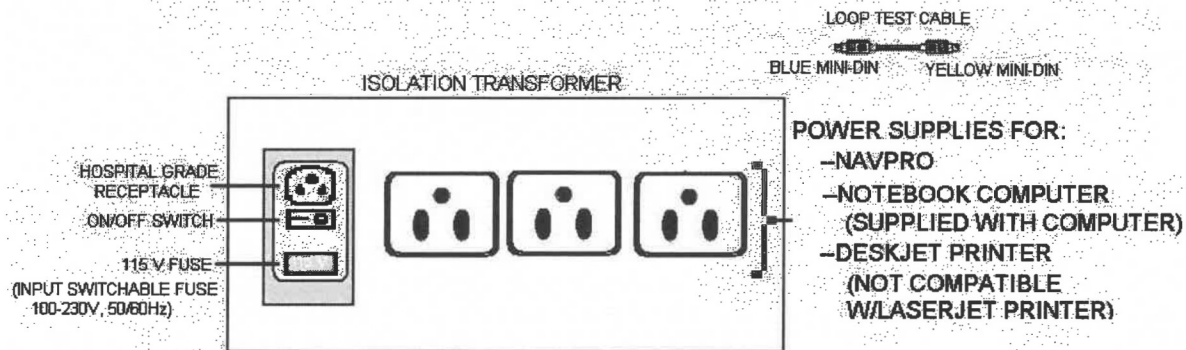
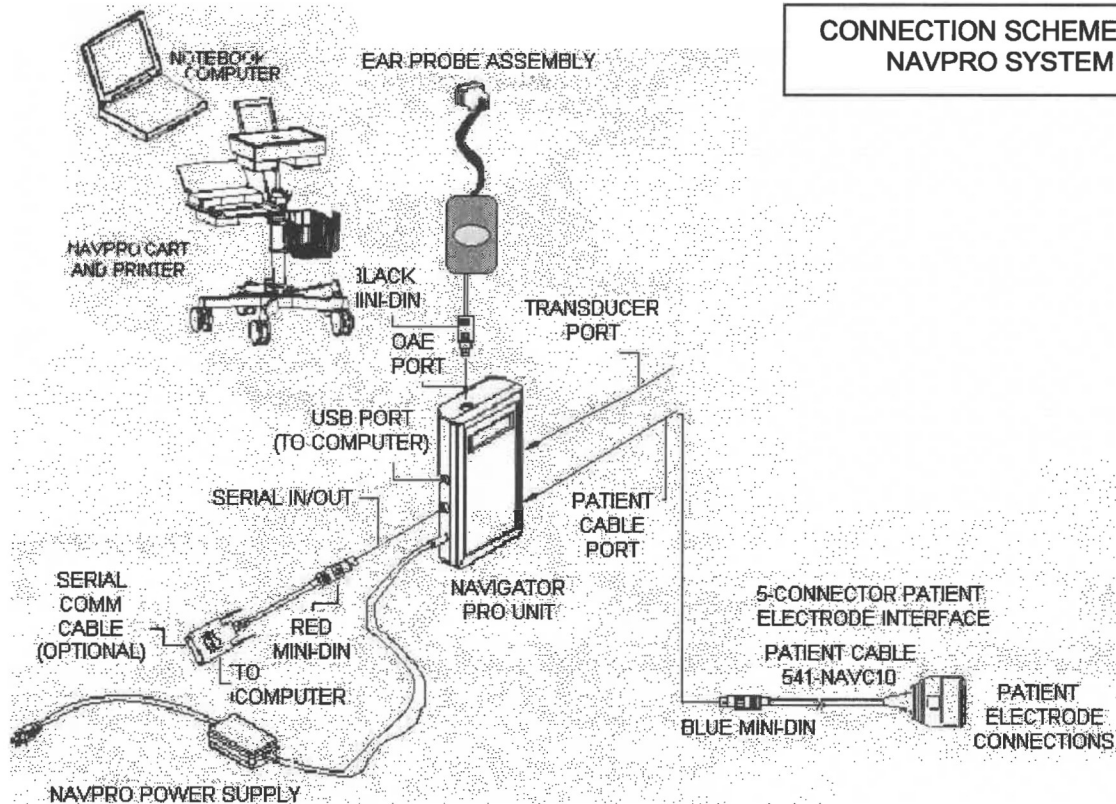
WARNING

Each of the colored plastic housings on the cables displays arrows that identify the top of the connector. This helps align the cable connector male plug to the female jack on the side of the ABaer system module. Careful alignment of the cable plug to the jack is important to reduce the chance of bending the metal pins inside the male connector. You must insert the plugs completely into the corresponding jacks for the system to operate properly. Never twist these connectors during insertion or removal. Twisting the connector in the socket may damage the metal pins and cause communication problems between the ABaer system module and the computer. It may also cause other system malfunctions involving stimulus delivery or ABaer system recording.

AVERTISSEMENT

Chacun des embouts en plastique de couleur des câbles porte des flèches qui indiquent le haut du connecteur, afin de permettre l'alignement de la fiche mâle du connecteur à la prise femelle sur le côté du module ABaer. Il est important d'aligner précisément la fiche à la prise afin de réduire le risque de déformation des broches métalliques du connecteur. Pour que le système fonctionne correctement, il faut insérer les fiches complètement dans les prises correspondantes. Ne jamais insérer ou retirer les connecteurs avec un mouvement rotatif. Tourner le connecteur dans la prise risque d'abîmer les broches métalliques et d'engendrer des problèmes de communication entre le module ABaer et l'ordinateur, et il est susceptible de causer d'autres défauts dans le fonctionnement du système, notamment l'envoi ou l'enregistrement par le système ABaer d'un stimulus.

CONNECTION SCHEME FOR NAVPRO SYSTEM





WARNING

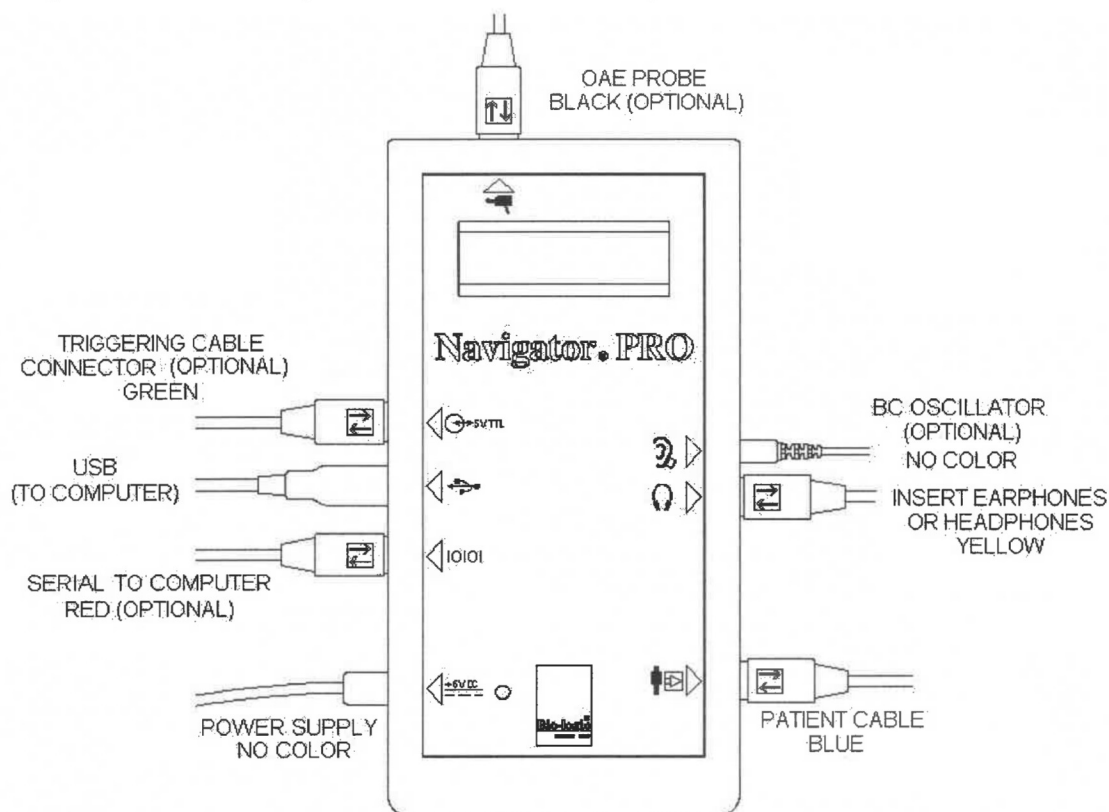
Make sure that any platform, table, cart, or other surface used during the operation, transport, or temporary or permanent storage of the system and its components is adequate, sturdy, and safe. Bio-logic Systems Corp is not responsible for any injury or damage that may result from inadequate, poorly constructed, or unapproved transports, carts, operating surfaces

AVERTISSEMENT

Veiller à ce que toute surface utilisée pour le fonctionnement, le transport ou le rangement temporaire ou permanent du système ou de ses composants, notamment toute plateforme, toute table ou tout chariot, soit de dimensions suffisantes, robuste et sans danger. Bio-logic Systems Corp. n'assume aucune responsabilité à l'égard des blessures ou dégâts découlant de l'utilisation de dispositifs de transport, de chariots ou de surfaces d'opération inappropriés, mal construits ou non homologués.

Hardware installation of the AEP system involves connecting several cables to the Navigator Pro module. Five (5) RS232 female connectors are on three sides of the Navigator Pro module. Each of these connectors has a different pin configuration. This reduces the risk of plugging the wrong cable into the connector. Additionally, colored rings around the connector sockets on the sides of the Navigator Pro module match the color of the plastic housing around the RS232 male connector end of the cable.

This figure shows color-coding for the connectors on the Navigator Pro module and cables:



Note: This illustration shows items only for AEP systems. For other systems, please make contact with Bio-logic Systems Corp Customer Support at 1-800-272-8075 or 1-847-949-5200.

You have a choice of transducers when purchasing your AEP system. All transducers must be supplied by Bio-logic Systems Corp to assure that they meet proper specifications. Depending on what you chose, some of the connector jacks on the sides of the Navigator Pro system will remain unused. For the system to operate, however, connections must be made to the blue (electrode connection cable), the red (serial cable) or USB connector, the power supply connector, and the yellow connector (transducer cable) for delivery of the stimulus into the ear.

Once the cable connections are made into the Navigator Pro module, additional connections must be made to complete the hardware installation. Insert the 9-pin D connector (female) end of the serial cable or the USB connector into the computer.

Quick Guide

Bio-logic Systems Corp Auditory Evoked Potential Quick Guide

1a. Open New File	1b. Open an Existing File
• Open Patient window is automatically displayed on startup or Select Open Patient icon. • Complete all required fields such as patient ID, Last Name, Birthdate, etc. Required fields are designated by an asterisk (*). • Optional: Enter any additional fields. • Select Accept. (Once Accept is selected you may enter Physician and Tested by.) • Select Begin Test.	• Open Patient window is automatically displayed on startup or Select Open Patient icon. • Use the drop down arrow to select by Patient ID or Last Name. If there is patient information in the fields, select Search Again or Clear All. • To review data, select box(s) next to test date. Select Review Data. • To review existing data while collecting new data, select box(s) next to test date. Select Begin Test.
2. Enter Additional Patient information (optional)	3. Select Protocol
• After a patient has been entered into the Open Patient window, To enter additional data for a new patient: -- From Open Patient window, select Database button. -- Complete fields under Patient Info Tab. -- Close Patient and Test Information window.	• Select desired protocol from drop-down list.
4. View or Modify Collection Protocols (optional)	5. Check Impedance
• Select Setup and then Collection Protocols. OR • Select Amplifier Parameters and/or Stimulus Parameters icon. • Modify parameters as desired. • To use protocol, but not save changes, select OK. • To save a new protocol, select Save As and designate a new name. • To overwrite the existing protocol, select Save.	• Select Impedance Check icon. • When impedance is acceptable, select Stop Impedance Check. • If impedance is not acceptable, correct problem. NOTE: Impedance check continuously cycles through all inputs so any changes take a few moments to appear on the screen.

6. Begin Collection

- Select **View EEG** icon to check the EEG prior to recording.
- Select **Record** icon to begin averaging.

Note: the stimulus always ramps up to the full intensity and ramps down when averaging is stopped.

- Allow program to collect to maximum number of stimuli as defined in protocol.

OR

- Select **Stop** icon to stop collection before maximum number of stimuli as defined in protocol is reached.

OR

- Select **Exceed Max** icon to collect beyond maximum number of stimuli as defined in protocol.

OR

- Select **Clear Average** icon to restart collection without saving the current data.

7. View Waves

As the waves collect, they load automatically as defined in Default Display Parameters.

To manually load waves

Click on the desired panel or select A or B in the bottom of the data tree window. This displays the data tree for that panel.

- Select radio button for channel 1, channel 2, ipsi, contra or both.
- Select the box next to the waveform you want to load.

OR

- Right click on the letterbox next to the desired record and select desired channel to load.

To view waves in the Review Data screen, expand the data tree by either left clicking on "+" next to data in the desired level or right click on text in data tree to expand to the desired level.

8. Mark Waves

Move cursor to desired point on active wave.

- Click the number in the toolbar representing the label you want.

OR

- Right click on wave. Left click and choose label, then Left click on the desired label.

To View Marked Point Information:

- Select the **Marked Point Info** icon,
- Right click on wave and Left click on Marked Point Information.

OR

- Place Cursor 1 (C1) on first point and Cursor 2 (C2) on second point.
- Latency and Amplitude for C1 and C2 and the difference between the two (C2-C1) are displayed below the panel.

9. Print Report

- Select **Patient**, then **Print Report**. A print preview of the report will be displayed.
- To select report templates other than the default, use the drop down arrow in the middle of the printing toolbar.
- Select **Print** icon.

QUICK GUIDE

Bio-logic Systems Corp Stacked ABR/CHAMP Quick Guide

NOTE: Must use Bio-logic Broadband or ER-2 Earphones for Stacked ABR. Bio-logic Broadband (ER-2) Earphones have a broader frequency response than the Bio-logic Insert or ER-3 Earphones that are used with regular ABR testing.

1. Open New File	1a. Add to an Existing File
- Select Open Patient icon. - Complete required fields (Patient ID, Last Name, Birthdate, Sex, etc.) Required fields are designated by an asterisk (*). You must have Gender of the patient entered for the absolute amplitude normative data to display. - Optional: Enter any additional fields. - Select Accept. - Select the Audiogram button; enter the Audiogram, select Save, Select Close. (The Patient's PTA between ears must be < 10dB for the software to calculate the Interaural Difference) - Select Begin Test.	- Select Open Patient icon. - Use the drop down arrow to select by Patient ID or Last Name. If patient information is already present, select Search Again or Clear All. - To review data, select box(s) next to Test Date. Select Review Data.
2. Enter Patient Information	3. Apply Electrode Leads
- From Open Patient Window, Select Database button. - Complete desired fields under the Patient Info tab. - Close Database by clicking on "X" at top right corner.	NOTE: Do not switch electrodes when changing stimulus ears. Input 1 / Channel 1 (White Jack) Cz (vertex = halfway from preauricular point to preauricular point and halfway from nasion toinion. Input 2 / Channel 1 (Blue Jack) Mid-mastoid left ear Common (Red Jack) Mid-mastoid right ear Mastoid electrodes must be placed symmetrically. Place on boniest portion of the mastoid to reduce Post-Auricular Muscle artifact (PAM).
4. Check Impedance	5. Select Protocol
Select Impedance Check icon. - When impedance is acceptable, select Stop Impedance Check. - Impedance must be low (less than 5.0k Ohms) and balanced (within 3.0k Ohms of each other). - If impedance is not acceptable, correct problem. NOTE: Impedance check continuously cycles through all inputs so any changes take a few moments to appear on screen.	- Select first desired protocol sequence from drop-down list (SEQ: LE Stacked ABR or SEQ: RE Stacked ABR) NOTE: Normative data is based on specific parameters. Do not modify the Stacked ABR Protocol Parameters. Changing any parameters invalidates norms. - When suspected ear is complete, select the sequence protocol for the other ear. NOTE: Do not manually switch the electrodes. Do not use the LR button.
6. Begin Collection	
- To check the EEG prior to recording, select View EEG button. - To begin collection of data, select Record button. This is a linked protocol. It proceeds through each stimulus change automatically. A delay message will appear between each protocol. The protocol will proceed to the next in the sequence as soon as the noise level drops below 20 nanovolts. Or, in the case of a noisy patient, it will collect 9728 stimuli before proceeding to the next protocol. The noise level and number of sweeps are displayed in the field tree. Options: Bypass Delay-Skips ten sec. delay between protocols in a sequence (not recommended). Skip to next protocol-Skips protocol and starts next protocol in sequence. End sequence-Stops collection of a sequence.	NOTE: It is very important that the patient is quiet during data collection. There is a ten second delay between each protocol run. Instruct the patient that they may move briefly when stimulus turns off. Repeating a Run If collection starts with high noise or PAM, you may re-instruct the patient and zero the average. You will need to re-collect any run that has PAM or high noise. Select the individual protocol that you want to repeat. (e.g. SABR: LE Stacked ABR, Click Alone) Ending the Sequence Select the End Sequence button.

7. Stacked ABR Analysis

- As the Click Alone and High Pass Responses are collected, they load automatically into panel A (left panel) for the left ear and panel B (right panel) for the right ear. **There must be responses for all six stimuli to complete calculations.**
- Panel with waveforms must be active, select **Calculate Derived Bands** icon.

This will automatically subtract each stimulus condition pair to obtain the derived-band response.

Integrated derived-band waves are displayed in panel A. De-trended (non-integrated) derived-band waves are displayed in panel B.

NOTE: The Sum Derived waveform should look very similar to the Click Alone waveform. If they are not similar, you have PAM in one or more of your recordings, or too much noise.

- Re-mark waves as needed.

The tag on the integrated waveforms (panel A) marks the peak of the wave (0) and corresponds to the zero crossing (0) on the non-integrated waveform (panel B). Verify that the placement of the peak on panel A is correct. The marked point of the peak (0) on panel A may be moved. This may be necessary if wave III has a larger amplitude than wave V. If no peak is present, it is recommended that the peak be marked at the same latency as the peak for the click alone response for that ear.

- Click in panel B.
- Select **Calc. Stacked ABR (0 Crossing)**.

This will automatically align the zero crossing point for each waveform. De-trended Derived bands are moved to panel A. The stacked ABR and the aligned derived bands are placed on panel B. The top wave (Stacked ABR) will be the sum of the aligned waveforms below it. The amplitude of the stacked ABR will be displayed in the lower right corner of the screen.

- Enlarge the view of normative data by selecting **SABR Normative Data** icon on the toolbar or next to the normative data window displayed on the bottom right corner of the screen as a magnifying glass icon.
- Analyze one ear at a time.
- To perform Interaural Comparison – load the Stacked ABR data set for the left ear on Panel A and the Stacked ABR data set for the right ear on Panel B. Remember the PTA must be <10 dB between ears.

8. CHAMP Analysis

- As the Click Alone and High Pass Responses are collected, they load automatically into panel A (left panel) for the left ear and panel B (right panel) for the right ear. **There must be responses for all six stimuli to complete calculations.**
- Panel with waveforms must be active, select **Calculate CHAMP** to mark click alone and click +500 Hz waves.
- Re-mark waves as needed.

To help determine which peak to mark in the 500 Hz high pass response, set the cursor at the latency of wave V in the Click Alone response and look at the latency of wave V in each of the high pass responses. In non-Meniere's disease/cochlear hydrops patients, the latency of wave V will move out in time as more high pass masking noise is added. In Meniere's disease/cochlear hydrops patients, the latency of wave V will change very little as more high pass masking noise is added. Remember to keep in mind the patient's hearing thresholds.

The Ratio is automatically calculated if required.

- Select **CHAMP Analysis** icon to compare results to normative data.

If either the Latency Delay or the Ratio is abnormal this is indicative of the presence of cochlear hydrops.

9. Print Report

- When analysis is completed for both ears, select one full set for each ear tested from the field tree.
- Select **Patient**. Select **Print Stacked ABR/CHAMP Report**.
- Select **Print** icon.

PATIENT PREPARATION

Note: Before preparing a patient, be sure to turn the Navigator Pro system on and launch AEP.

Any AEP test involves placing recording electrodes on the patient's head. These electrodes record the electrical activity generated by the auditory nervous system. Such activity results from the presentation of an acoustic stimulus into the ear. The stimulus is delivered to the ear via earphones that are coupled to the ear with an eartip that is inserted into the ear canal. A starter kit containing the supplies that you need to perform an AEP/Stacked ABR/CHAMP test comes standard with the system purchase. Additional disposable items are available from Bio-logic Systems Corp. These can be ordered by calling the Supplies Department at 1-800-456-5205.

In addition to the techniques of electrode application and insert earphone placement, testers would benefit from experience and training in standard ABR. AEP/Stacked ABR/CHAMP tests are most successful and fastest when performed on a comfortable patient. If the patient is agitated or active, the test may be prolonged or the results may be compromised by a high level of background noise (acoustic or myogenic) during the recording.

Supplies Required

The following supplies should be stocked in the area where the patient is prepared:

- Tape measure (for measuring Cz and bilateral mastoid electrode placement).
- Hair clips and hair bands (helpful to secure hair away from the electrode sites).
- Marking pencil (for marking electrode sites on the skin after careful measurement).
- Nuprep™, alcohol prep, or other skin prep materials.
- Gauze pads or cotton swabs for the application of the Nuprep™.
- Electrodes (clean, standard, matched metal cup electrodes; braid or tape electrodes together for best performance).
- Conductive Electrode paste or cream.
- Cotton balls and/or tape for securing electrodes to the sites.
- Disposable eartips in adult and pediatric sizes that are compatible with the Bio-logic or ER3 Insert earphones for AEP or the Broadband or ER2 insert earphones for Stacked ABR/CHAMP.

Test Room Setup

The patient must be comfortable in order to get good test results. The patient should be lying down on a bed or reclining in a comfortable chair with proper head and leg support. Pillows and blankets should be available so the patient can be made as comfortable as possible in an attempt to induce natural sleep. It is also desirable to be able to turn off the lights to encourage the patient to sleep.

It is also important to situate the patient and electrodes away from any concentrated sources of electrical artifact such as computer monitors.

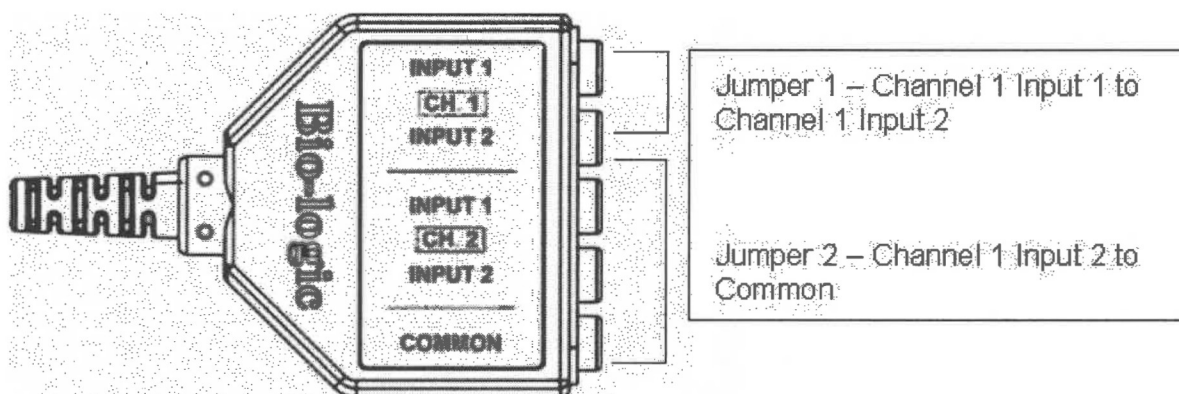
Performing a Listening Check

Listening checks should be performed routinely to ensure that your equipment is functioning properly.

1. Plug the Insert (ER3) or Broadband (ER2) earphones or headphones into the Navigator Pro box.

Note: Make sure you use the correct earphones. The Insert (ER3) earphones are for AEP and the Broadband (ER2) earphones are for Stacked ABR/CHAMP.

2. Enter Patient Information and click Begin Test.
3. Choose 1 Channel Protocol.
4. Short out the electrode connections by connecting the jumper cables per the illustration or plug in the blue end only of the loop test cable into the patient cable connector.



5. Check stimulus through right and left earphones:
 - a. Click the Record button.
 - b. Listen to the stimulus.
 - c. Make sure the EEG signal is flat.
6. For AEP you want to verify that subjects with normal hearing can hear the stimuli at 0-5 dB.
7. For Stacked/CHAMP you want to verify the stimuli for the following protocols for right and left:
 - a. Click Alone.
 - b. Click + 8000 Hz High Pass Masking (you should hear the click and masking together).
 - c. Click + 500 Hz High Pass Masking (you should barely be able to hear the click, if at all).

Test Room Considerations

As with any test of auditory function, the ambient noise level in the test environment must be controlled to insure a reliable test. Ideally, any procedure should be performed in a sound-treated booth to achieve maximum control of the acoustic environment. If this is not possible, the tester must be sensitive to potential sources of ambient noise and the impact that uncontrolled noise can have on test results. Everything possible should be done to assure that the acoustic noise levels in the room remain as low as possible throughout the entire test procedure.

In addition to acoustic noise, the test room must be conducive to collection of good quality AEP data from the standpoint of electrical noise as well. Electrical noise generated by computers, pagers, cellular phones, etc. can interfere with data collection.

It is important that the tester can see and hear the patient during the test to make sure they remain relaxed and quiet. If you are performing the test in a sound booth with a separate control room, be sure to turn on the audio monitoring system so you can hear the patient.

Electrode Application Sites

Recordings are performed using one or two amplifier channel(s) and a ground. Refer to the Electrode Connections for Bio-logic AEP System Section for proper electrode placement for specific tests.

Skin Preparation

The skin at the electrode sites must be prepared to assure a good recording. To prepare the skin at these sites, use an electrode skin preparation material such as NuPrep™ on a cotton swab or gauze pad to clean each of the areas. Note that these cleansing materials are slightly abrasive. If using the standard cup electrodes, fill the cup electrode with a dollop of conductive electrode paste. If placing electrodes on the scalp, non-disposable electrodes are recommended. Then place the electrodes on the prepared sites securing them with a cotton ball and/or medical tape. Use of alcohol at vertex electrode site may help dissolve hair product and serve to decrease impedance at that site.

If using disposable electrodes, dry prep pads work the best. Alcohol can dry out the skin preventing the disposable electrodes from adhering to the skin. If using NuPrep™, wipe the electrode prep site to remove excess moisture.

Once the electrodes are securely affixed to the patient's scalp, you are ready to proceed. Connect the electrodes to the Navigator Pro system patient cable and check impedance within AEP (see the Performing an Impedance Test section of this document).

Non-Disposable Electrodes

Good Clean Electrodes Assist in Collecting Good Clean Data.

All electrodes should be the same metal type. Do not use a combination of electrode metal types (i.e silver, silver chloride, gold). It is important to replace old and or worn electrodes to get good electrode impedance measures. Electrodes with debris embedded in them can cause higher impedance readings.

Electrodes should be clean. Use a soft toothbrush (child's toothbrush works well) to clean paste out of the electrode cups. Do not leave electrodes soaking in water for hours. The electrode lead wires should be braided or taped together and secured away from the transducer cable and any power cords nearby.

If using silver chloride electrodes, check to make sure the chloride has not chipped off. To re-chloride the electrodes, place only the cup of the electrode into a small amount of chlorine bleach. Soak electrodes for only 20 minutes. Do not let the wire leads touch the chlorine bleach.

Electrode Impedance Check

Once the electrodes are connected to the patient cable, check impedances (see the Performing an Impedance Test section of this document). If the electrode impedance is too high, you will need to remove the electrode at that site and prep the area again with the chosen skin preparation material.

Low and balanced impedance values are critical to achieving high quality, low noise data. **Impedance values should be 5.0 k Ohms or less and the inter-electrode difference should not exceed 2.0 k Ohms.** If any of the values fall outside of these criteria, the sites that do not meet the criteria should be rescrubbed and the impedance should be checked again.

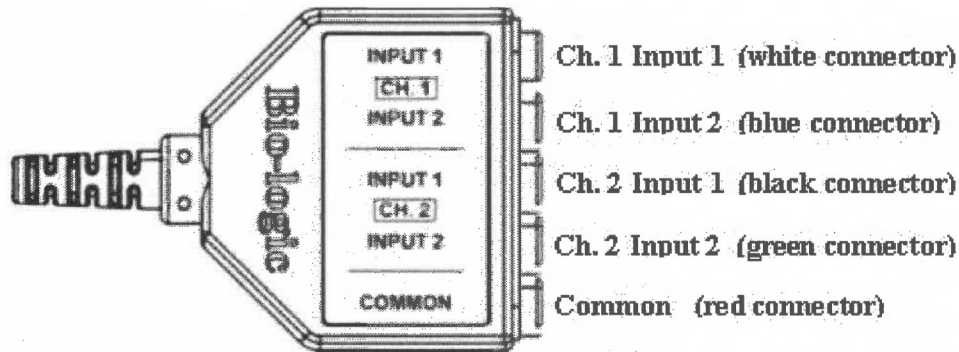
Patient State

It is important that the patient is as comfortable as possible when you begin the AEP/Stacked ABR/CHAMP test. Be sure to offer the patient an opportunity to use the restroom prior to data collection.

For the AEP/Stacked ABR/CHAMP procedure, the patient should be lying down on a bed or reclining in a comfortable recliner chair. The neck should be supported and comfortable to avoid muscle artifact. A pillow and blanket should be available so that the patient can be made as comfortable as possible.

Electrode Connections for Bio-logic AEP System

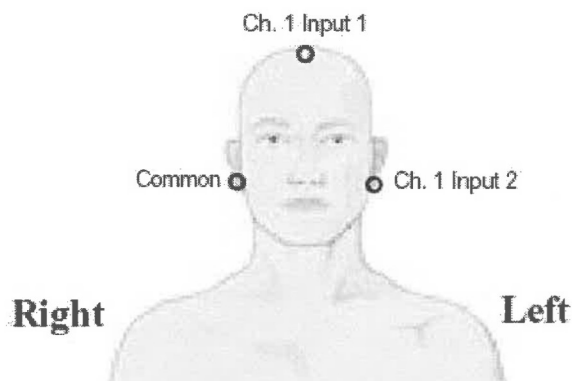
Descriptions appear below for the proper connection of electrode wires into the Navigator Pro patient cable for 1-channel or 2-channel recordings of different types (ABR, ECoG, VEMP, Stacked ABR/CHAMP). These electrode montages for various test procedures are suggested and represent commonly used montages for data collection. However, other montages may be appropriate for some of the test procedures described.



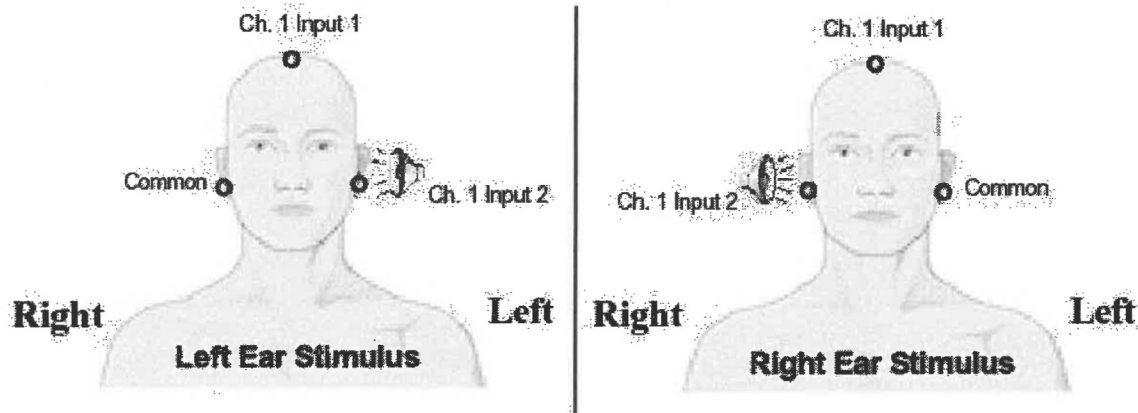
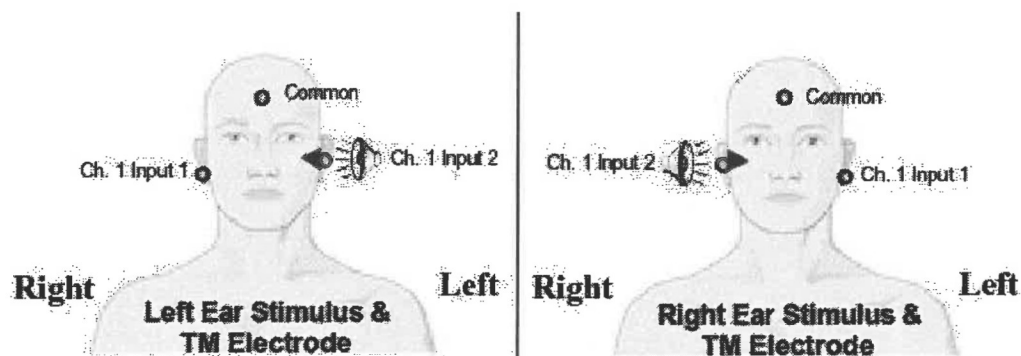
IMPORTANT NOTE:

1-Channel Recordings: For 1-channel recordings, both connectors for Ch. 1 (Input 1 and Input 2) will be used as well as the Common connector. For 1-channel recordings, the inputs for Ch. 2 are not used and should be empty. No jumper should be connected to the patient cable for 1-channel recordings. Leaving a jumper connected during 1-channel recordings will result in incorrect data.

1-Channel ABR – Electrode Switching Enabled

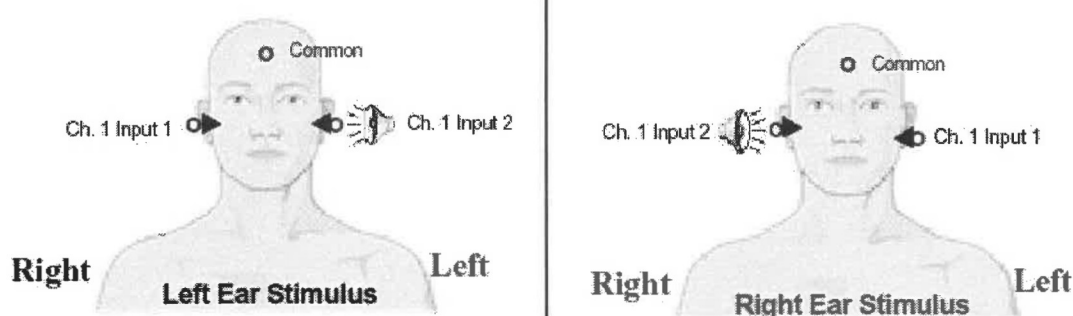


Caution: The Common and Ch. 1 Input 2 electrodes **MUST** be plugged in as shown when electrode switching is enabled in order for the electrode switching to function properly! Failure to connect this way will result in inaccurate data.

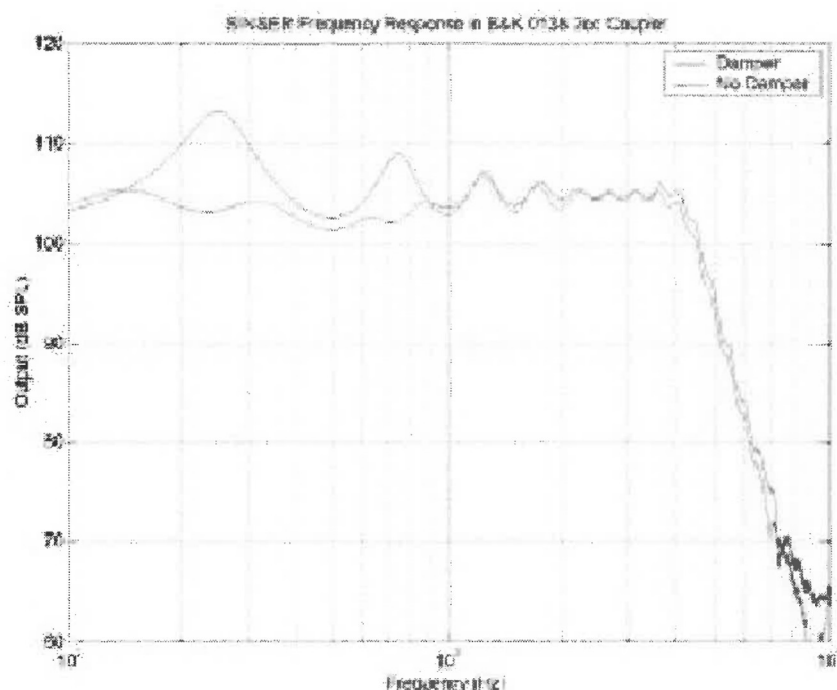
1-Channel ABR –**Electrode Switching Disabled – requires manual switching of electrodes****1-Channel TM ECochG (horizontal montage) –****Electrode Switching Disabled – requires manual switching of electrodes**

The special electrode cable provided with the Bio-logic TM electrode is a shielded cable. The "green" connector on the TM electrode cable plugs into the Common input on the patient cable and the electrode at the "Common" site above plugs into the top of the green "jumper". The "red" connector on the TM electrode cable plugs into the Ch. 1 Input 2 connector.

**1-Channel Tiptrode ECoG (horizontal montage)–
Electrode Switching Disabled – requires manual switching of electrodes**

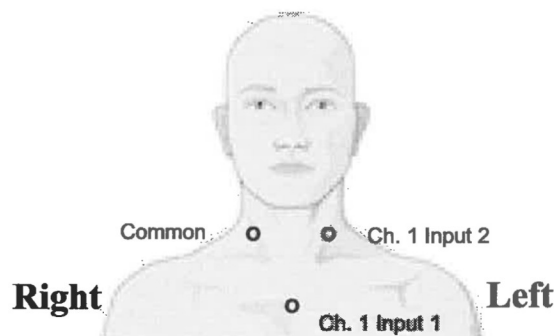


The use of Tiptrodes with insert earphones with part number 580-SINSER must be done with caution. These transducers have a damper in the adapter at the end of the red and blue tubing that smooths peaks in the frequency response. These dampers are not present and cannot be added to the Tiptrodes. Use of Tiptrodes on the 580-SINSER insert earphones will result in slightly higher output (3-8 dB) than is specified in the software for the click stimulus and for certain tone bursts. The frequency response of the 580-SINSER insert earphones with and without the damper is shown in the graph below for your reference.



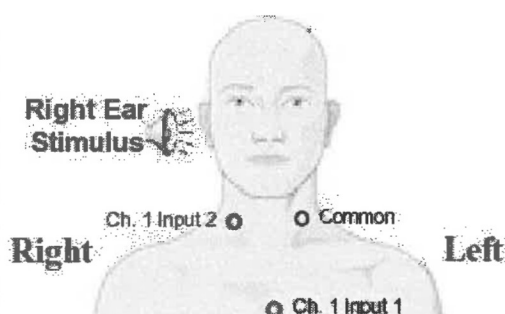
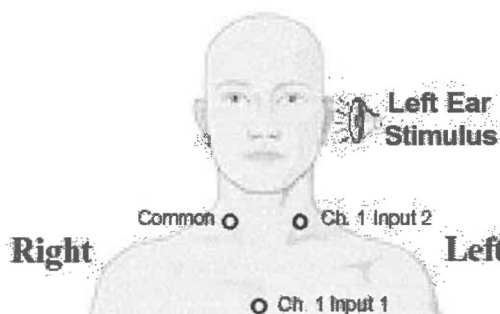
Use of Tiptrodes (which do not have acoustic dampers) with the 580-SINSER insert earphones will result in a frequency response as shown by the blue or more “peaky” line above. Be aware that use of Tiptrodes with the 580-SINSER will impact the stimulus frequency response and output.

1-Channel VEMP – Electrode Switching Enabled

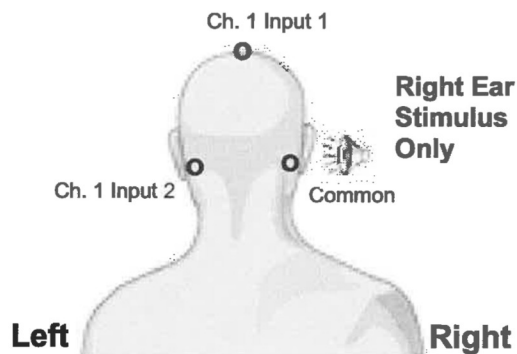


Caution: The Common and Ch. 1 Input 2 electrodes **MUST** be plugged in as shown when electrode switching is enabled in order for the electrode switching to function properly! Failure to connect this way will result in inaccurate data. **The VEMP will be displayed with P1 recorded downward.**

1-Channel VEMP – Electrode Switching Disabled – requires manual switching of electrodes

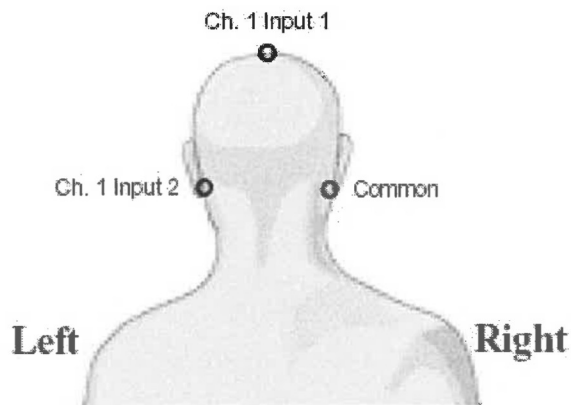


BioMAP Electrode Switching Enabled



Caution: The Common and Ch. 1 Input 2 electrodes **MUST** be plugged in as shown when electrode switching is enabled in order for the electrode switching to function properly! Failure to connect this way will result in inaccurate data. **Use Cz and not high forehead since the normative data was collected this way.**

Stacked ABR/CHAMP – Electrode Switching Enabled

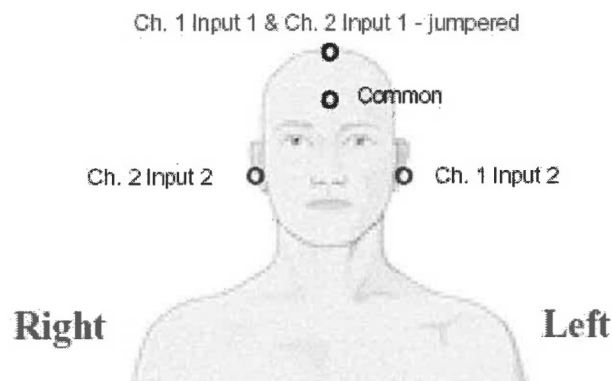


Caution: The Common and Ch. 1 Input 2 electrodes **MUST** be plugged in as shown when electrode switching is enabled in order for the electrode switching to function properly! Failure to connect this way will result in inaccurate data.

IMPORTANT NOTE:

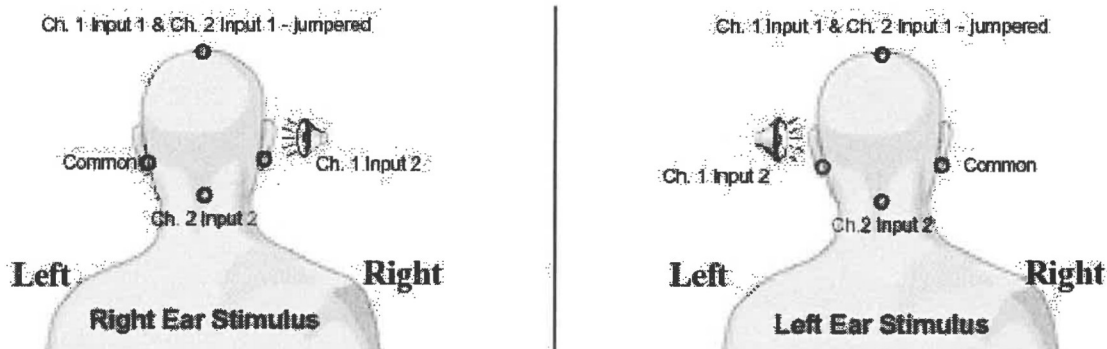
2-Channel Recordings: For all of the 2-channel recordings described below, a jumper is used in the patient cable to connect two inputs together so that one electrode site can be shared by both connectors. In that case, the term “jumped” is used in the descriptions below to describe how this is accomplished.

2-Channel ABR



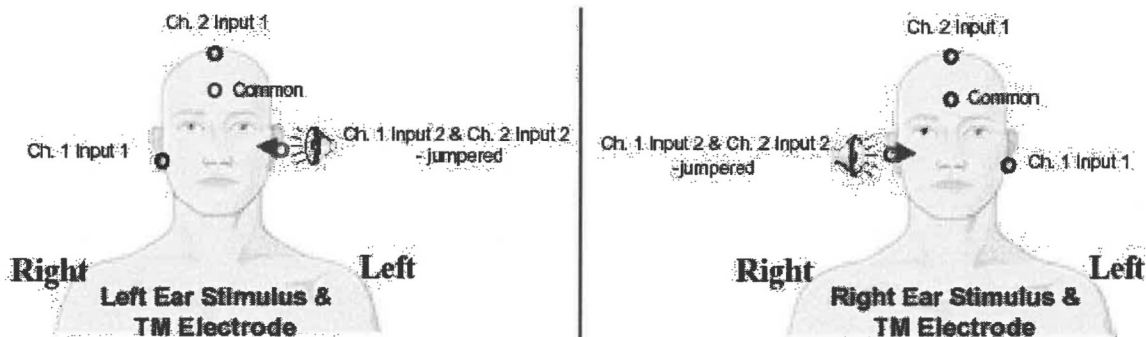
Consider using the nape of the neck as an alternate common electrode placement, particularly if you plan to collect ASSR data with MASTER immediately after collecting ABR data. You will need to change the connection of electrodes into the patient cable for MASTER since it is a one-channel system, but you will not have to reapply electrodes to different sites on the patient.

2-Channel ABR (Ch.1: Cz-Ipsi montage) & (Ch. 2: Cz-Nape montage)



Requires manual switching of electrodes upon changing stimulated ear.

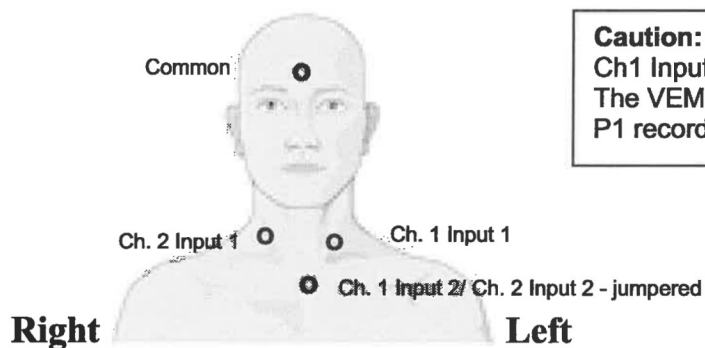
TM ECoG (Ch.1-horizontal montage) & ABR (Ch. 2)



The special electrode cable provided with the Bio-logic TM electrode is a shielded cable. The "green" connector on the TM electrode cable plugs into the Common input on the patient cable and the electrode at the "Common" site above plugs into the top of the green "jumper". The "red" connector on the TM electrode cable plugs into the Ch. 1 Input 2 connector.

Requires manual switching of electrodes upon changing stimulated ear.

2-Channel VEMP – Binaural or Monaural Stimuli



Caution: Place the jumper in the Ch1 Input 2 and Ch2 Input 2 jack. The VEMP will be displayed with P1 recorded upward.

INSERT EARPHONES

Insert Earphone Application

Before inserting the earphone tips into the patient's ears, tell the patient about the test stimuli and test procedures. Inform the patient that they should close their eyes try to relax.

Proper placement of the ear tip is important to ensure adequate stimulus delivery to the ear. Regardless of the transducer, it is important to verify that the placement of the transducer is accurate so that when a right ear test is specified in the program, it is the right ear that is truly receiving the stimulus. Incorrect placement of the earphones can result in poor quality recordings, increase the chance that a refer result will occur, and/or result in assigning the test results to the wrong ear.

Bio-logic or ER3 Insert Earphones

The Bio-logic or ER3 insert earphones are provided with your system but are not to be used with Stacked ABR/CHAMP. Use of Bio-logic Broadband or ER2 insert earphones is not recommended when you are collecting standard ABR data to assess standard measurements such as interaural Wave V differences, latency or interlatency measures. This is because the normative data that most testers use for evaluation of these standard ABR measures were collected using standard insert earphones.

Insert earphones include one transducer for each ear. The tubes into the transducers are color-coded to assist in the proper placement of the correct transducer in each ear. The red tube must be used on the right ear and the blue tube must be used on the left ear. Foam disposable eartips in adult and pediatric sizes are available. Be aware that these foam tips differ for the Bio-logic or ER3 insert earphones (foam tip with black tubing) and for Broadband or ER2 earphones (foam tip with clear tubing).

The disposable eartip couples to the adapter at the end of the tubes. The foam tip must be securely inserted into the ear canal following the color-coding scheme of red transducer for the right ear and blue for the left ear. The outer edge of the foam on the eartip should be flush with the opening of the patient's ear canal. Too superficial of a placement in the ear canal may result in the eartip slipping out of the ear during the test resulting in poor quality data due to reduction in the stimulus intensity delivered into the ear canal.

Use the largest eartip possible to reduce the risk of stimulus leakage outside the ear canal. Such leakage can result in reduction in the stimulus dB SPL at the ear canal.

Note: If you are currently using ER3 inserts and purchase Bio-logic Inserts, you need to contact Technical Support to determine if the NavPro box will need a modification before the new Bio-logic Inserts can be used.

Bio-logic Broadband or ER2 Insert Earphones

The Bio-logic Broadband or ER2 insert earphones MUST be used to collect Stacked ABR/CHAMP data. These inserts have the extended high frequency response needed to acquire valid data for the Stacked ABR/CHAMP procedure. Data collected with the standard insert earphones cannot be compared to the available normative data for Stacked ABR/CHAMP.

No other transducer type is appropriate for Stacked ABR/CHAMP measurements.

Note: If you are currently using ER2 inserts and purchase Bio-logic Broadbands, you need to contact Technical Support to determine if the NavPro box will need a modification before the new Bio-logic Inserts can be used.

Tubes, adapters, and tips for Bio-logic Insert (ER3) and Broadband (ER2) Earphones

To achieve accurate output from your insert earphones you **MUST** use the tubes, adapters and disposable tips that are intended for the specific inserts that you are using. In some cases alternate pieces will fit onto the inserts but using non-compatible components can affect the transducer output and accuracy of data.

Be sure to use only the accessory components that match your insert earphones as described.

ER3 (Etymotic Research) Insert Earphones



- #202150 – Replacement Red/Blue tubing with white plastic tip – (pair)
- #202160 – Replacement plastic tips – (10/pkg. White)
- #202140 – Impedance tip adapter (black) and Red/Blue tubing – (pair)
- #06900 – Halo/Ear Muffin™ acoustic tips with tubing (white) – (pair)
- #202121 – Pediatric disposable foam tips – black straw (50/pkg)
- #202122 – Adult disposable foam tips – black straw (50/pkg)
- #202123 – Jumbo disposable foam tips – black straw (24/pkg)

ER2 (Etymotic Research) Insert Earphones(Stacked ABR/CHAMP)



- #202128 – Replacement clear Red/Blue stripe tubing with black plastic tip – (pair)
- #202126 – Replacement plastic tips (10/pkg. Black)
- #202124 – Pediatric disposable foam tips – clear straw (50/pkg)
- #202125 – Adult disposable foam tips – clear straw (50/pkg)

Bio-logic Insert Earphones



580-SINSER-008 or 580-SINSER-012
8 foot cable 12 foot cable

- #202250 – Replacement Red/Blue tubing with gray square plastic tip – (pair)
- #202260 – Replacement plastic tips – (10/pkg Gray square)
- #202240 – Infant tip adapter and red/blue tubing – Gray (pair)
- #206920 – Halo/Ear Muffin acoustic tip with red/blue tubing – Gray (pair)
- #202121 – Pediatric disposable foam tips – black straw (50/pkg)
- #202122 – Adult disposable foam tips – black straw (50/pkg)
- #202123 – Jumbo disposable foam tips – black straw (24/pkg)

Bio-logic Broadband Insert Earphones (Stacked ABR/CHAMP)



580-BINSER-008 or 580-BINSER-012
8 foot cable 12 foot cable

- * #202270 – Replacement Red/Blue tubing with Blk round plastic tip– (pair)
- * #202280 – Replacement plastic tips – (10/pkg Blk round)
- * #202124 – Pediatric disposable foam tips – clear straw (50/pkg)
- * #202125 – Adult disposable foam tips – clear straw (50/pkg)
- * Must use these parts with Broadband inserts

TIPRODES

Tips for using Tiptrodes

The Tiptrode is an ear canal electrode that you can use with an insert earphone to deliver auditory stimuli and to record concurrent brain electrical activity. This device has the advantages of an insert earphone (for example, reduced stimulus artifact) as well as the advantages of an ear canal electrode (that is, closer proximity to generators of the auditory brainstem response).

The Tiptrode consists of two components: the eartip/electrode and the connector/cable assembly. The electrode is a foam eartip wrapped with a gold foil film. The connector/cable assembly consists of an insulated connector-clip for attaching the earplug/electrode to the tubing for transmitting the auditory stimulus, and an insulated wire to conduct the electrode signal.



WARNING

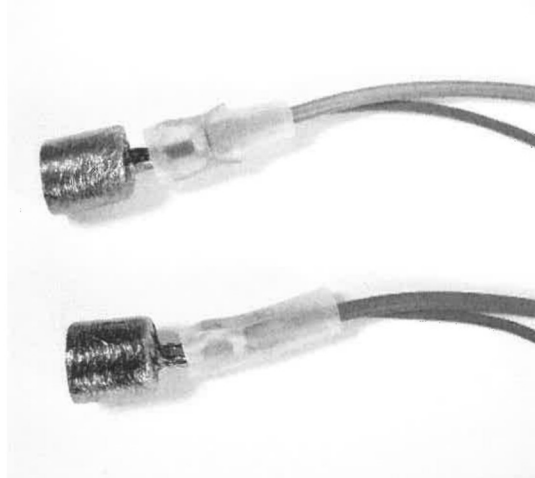
Use of Tiptrodes on the 580-SINSER insert earphones will result in slightly higher output (3-8 dB) than is specified in the software for the click stimulus and for certain tonebursts. See Electrode Connections for Bio-logic AEP System section if using Bio-logic Inserts.

AVERTISSEMENT

L'utilisation de TIPtrodes sur les écouteurs 580-SINSER résultera d'un son plus haut (de 3 à 4 dB) que celui déterminé dans le logiciel pour le clic stimulus et pour certaines impulsions sonores. Voir le paragraphe sur les connexions des électrodes pour l'appareil Bio-logic si vous utilisez des écouteurs Bio-logic.

Equipment setup

1. Attach the eartip/electrode to the connector. Squeeze open the metal clip; then, push the eartip/electrode tube over the opening on the connector.
2. Release the metal clip.
Make sure that the clip makes good contact with the gold foil wrapping.
3. Connect tubing to the standard output of the insert earphone:
 - Remove the red and blue tubing on the Insert earphones and replace it with the red and blue Tiptrodes tubing. Do **NOT** double the length of the tubing by attaching 2 sets of tubing together.
 - Connect the red tubing to the right insert earphone; connect the blue tubing to the left insert earphone.
4. Attach the electrode leadwire to the patient cable. See the Electrode Connections for Bio-logic AEP System section of this document.



TM ECOCHGTRODE ELECTRODE

Tips for using Bio-logic TM ECochGtrode Electrode

Perform an otoscopic examination before trying to insert the TM (tympanic membrane) electrode into the ear canal. If the ear canal is clear of cerumen, no other preparation of the ear canal is required. A qualified medical practitioner should clear an ear canal obstructed by cerumen before using a TM ECochGtrode. Do not try to place a TM ECochGtrode if there is evidence of a TM perforation. **Place 2cc of saline into the ear canal and then drain the ear. Saline will help reduce the impedance.**

Inform the patient that you will be passing a small, flexible tube down the ear canal and that they will feel a slight pressure and perhaps a "thud" when the end of the electrode makes contact with the eardrum.

Use a very small amount of conductive gel to cover the hydrogel end of the TM ECochGtrode to make it slick and less tacky (too much gel can plug the insert). It is recommended, that the ear canal be under direct lighting and electrode insertion with the aid of a microscope is appropriate.

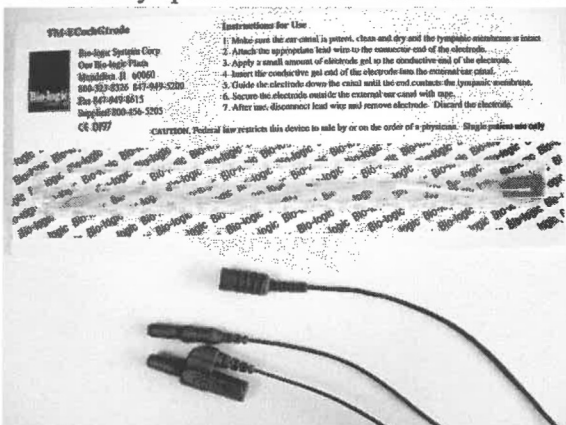
After the TM ECochGtrode is in contact with the TM, as reported by the patient or when resistance is met, secure the cable to the patient with a piece of tape to prevent the weight of the cable from pulling the electrode out of position.

Compress the appropriate size earphone tip and insert it into the ear canal on top of the TM ECochGtrode tubing. As you insert the tip into the canal, hold the TM ECochGtrode tubing so that the pressure of pushing the tip into the canal does not displace the TM ECochGtrode or push the electrode farther into the ear canal (this could cause some discomfort for the patient).

Electrode impedance will be very high for the TM ECochGtrode (>20 K ohms) and you therefore may have a large inter-electrode impedance difference. Because the response is so much larger when using a TM ECochGtrode than when using a standard electrode, this inter electrode difference is less of a problem. Proceed with collection, with artifact rejection disabled, despite the high impedance for the TM ECochGtrode.

Use a custom shielded cable with the TM ECochGtrode. The socket end of the TM ECochGtrode connects to the recessed pin end (gray) of the cable. The red safety connector of the cable couples to the inverting (Channel 1/Input 2/Reference) electrode position on the patient cable. The green safety connector couples to the Common position jack. Skin preparation and placement of the other electrodes in the montage is performed as usual. A forehead ground electrode plugs into the green safety connector. A surface electrode on the opposite ear is needed (Channel 1/Input 1/Active). See **Electrode Connections for Bio-logic AEP System section.**

After completion of the test, remove the insert earphone foam tip, then the TM ECochGtrode. After removing the TM ECochGtrode, inspect the ear canal and the tympanic membrane. There may be a small amount of residual electrode gel on the tympanic membrane. The tympanic membrane may be inflamed in the area where the electrode was placed. The gel residue will dry and flake off in a few days and will be extruded from the canal in the normal, physiologic cleaning process. The tympanic membrane inflammation should abate within a few hours after electrode removal.



Vestibular Evoked Myogenic Potential (VEMP)

A VEMP test can be performed using the AEP system. This document describes suggested patient setup procedures. There is a default toneburst VEMP protocol in the protocol drop down list.

If using VEMP with EMG Rectifying, you must use VEMP:VEMP Default protocol in order to have access to the Pre-stim Rectify button on the calculations toolbar.

Default Display Parameters

Display Scale: Use Epoch based scaling and set the scaling for the epoch size at 40 μ V. The larger the value, the smaller the response will be on the screen. If you choose auto-specific scaling, be aware that the waveforms are scaled to the largest response on the waveform panel. However, each of the two waveform display panels scale independently so waveforms on Panel A may be at a different scale than waveforms on Panel B.

Patient Setup



Figure 1

You will need to apply 3 electrodes since this is a one channel recording. You can use disposable and/or non-disposable electrodes. You need to prep the electrode sites as for any other AEP test. See Figure 1. The electrode sites are:

- Left sternocleidomastoid - have patient turn head all the way to the right. The sternocleidomastoid muscle is the long muscle extending down the side of the neck. Place the electrode midway down on this muscle.
- Right sternocleidomastoid - have patient turn head all the way to the left. The sternocleidomastoid muscle is the long muscle extending down the side of the neck. Place the electrode midway down on this muscle.
- Sternum - place the electrode on the lateral end of the upper sternum. High forehead is an alternative placement. Note: with the forehead placement the waveform will be inverted from the example displayed.

Electrode Montage

If your system or protocol **does** perform automatic switching of the reference and ground electrode based on stimulated ear, then use this electrode montage (See Electrode Connections for Bio-logic AEP System section):

Active (channel 1, input 1): Sternum
Reference (channel 1, input 2): Left side sternocleidomastoid
Ground: Right side sternocleidomastoid

In this case, **DO NOT** swap the electrodes in the cable (Channel 1, Input 2 and Common) when you change sides. The software will do this automatically if electrode switching is enabled in the protocol.

OR

If your system or protocol **does not** perform automatic switching of the reference and ground electrode based on stimulated ear, then use this electrode montage (See Electrode Connections for Bio-logic AEP System section):

Active (channel 1, input 1): Sternum
Reference (channel 1, input 2): Sternocleidomastoid on the side of the stimulated ear
Ground: Sternocleidomastoid on the side of the non-stimulated ear

You must swap the electrodes in the cable (Channel 1, Input 2 and Common) when you change sides.

See **Electrode Connections for Bio-logic AEP System section for 2 Channel setup with binaural stimulation.**

Patient Instructions

The stimulus must be loud to elicit the response so you should prepare the patient for loud stimulus. Once the electrodes and transducer are placed on the patient, have the patient lie down in a supine (i.e., on the back) position on a flat surface. Ask the patient to lift his/her head up unsupported, with shoulders still on the flat surface and maintain this position while the stimulus is on. See Figure 2. You will need to average between 128 to 256 responses. In a young normal subject, the response will be visible after only 20-30 stimuli.

Recording the VEMP test



Figure 2

Markings

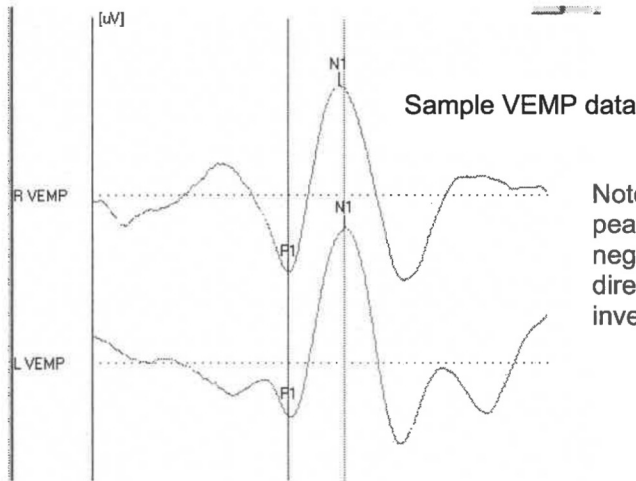
Expected latency for the major response components:

P1 (P13) = ~ 8-12 msec

N1 (N23) = ~ 20 msec

Typical peak to peak amplitude:

P1-N1(P13-N23) = 20-100 microvolts



Note: With the 1 channel montage, positive peaks display in a downward direction and negative peaks display in an upward direction. Forehead placement will result in inverted waveforms.

Interpretation

The response amplitude is variable and usually ranges between 20-100 uV. However, it can be much larger than this depending on the intensity of the stimulus and patient effort. The response reproducibility between replications and the symmetry of the P1-N1 amplitude between sides are important for interpretation. The response should be highly reproducible from trial to trial on the same side.

Asymmetry Ratio: $100 \times (\text{Amp L} - \text{Amp R}) / (\text{Amp L} + \text{Amp R})$

EMG Rectifying

The EMG Rectifying controls for the magnitude of the tonic Sternocleidomastoid (SCM) muscle activity by assessing its amplitude prior to stimulation (10 msec prestim measurement). This amount of SCM muscle activity is divided into the 256 points along the VEMP response.

By using the EMG Rectifying, if a VEMP amplitude is reduced on one side compared to the other, you are assured that the response reduction is due to a vestibular abnormality and not due to a lack of tonic SCM muscle contraction caused by improper patient position or fatigue.

Use VEMP_2 template to print out the VEMP recordings. This template will designate which waveforms have been pre-stim rectified.

This feature can be added to your NavPro system.

Bone Conduction ABR

Bone Conduction ABR provides a differential diagnosis of the type of hearing loss (sensorineural, conductive or mixed).

The system comes with a 1 channel default bone protocol. If you are not using masking, a 2 channel protocol is optimal. The contralateral response will have no wave I present a slightly longer latency for wave V. Wave I is not always present in the ipsilateral response.

Listening Check

Perform a listening check to verify that the output of the bone oscillator is accurate. See Patient Preparation – Performing a Listening Check section.

If the lowest level of the click stimuli subjects with normal hearing can hear the bone oscillator is 20 dB, then you have a 20 dB correction factor.

To adjust the calibration so that 0 dB on the dial is 0 dB output, you would add 20 to the value in the Bone Oscillator Transducer Calibration table for click in the HL column. See Transducer Calibration section. Note: that the maximum output will also be reduced by the amount added to the value (i.e. if you had 75 dB as maximum output it will be reduced to 55 dB once the correction is made).

Electrode Placement

Always use front of the earlobe placement instead of back of earlobe or mastoid. Placing the electrode too close to the bone oscillator causes artifact and noise in the ABR recording.

Bone Oscillator Placement

It is recommended that the bone oscillator be placed on the mastoid. According to ANSI S3.6 1996 using a forehead placement on an adult head can reduce output as much as 15 dB. An infant with a soft spot or fontanel could result in further reduction.

Hand Held Option

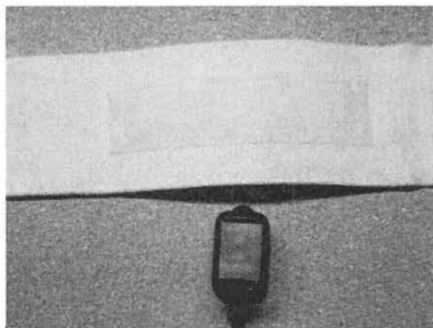
Most bone oscillator headbands are too big for infants. Hand-held placement can be used. Firmly hold the oscillator to the infant's mastoid with 1 index finger. Push the oscillator on the mastoid until you could almost push the child's head away from you. Make sure the oscillator is not touching the pinna. Transducer placement should be consistent to reduce variability. Never use 2 fingers to hold it as this can dampen the output.



BONE CONDUCTION

Catheter Holder

Dale Medical Products makes the Foley Catheter Holder (Latex Free) that works well for holding the bone oscillator. It's a 1 inch band.



Cut off the strap for the catheter and put some Velcro on the back of your bone oscillator. The elastic and Velcro makes it adjustable for smaller head sizes. Place the bone oscillator against the skin of the patient and wrap the Velcro strap around the patient's head to secure. Make sure the oscillator is not touching the pinna.



Contact Dale Medical Products to order

Phone: 800-343-3980

International: 508-695-9316

Website: <http://www.dalemed.com/products/foleycath.html>

Product#: H84103161

Other Recommendations

Start at a moderate level - 30 dB nHL. If you start too high the infant may wake up if in natural sleep.

Do not exceed 50 dB nHL. You will overdrive the oscillator.

20 dB nHL and below is within normal limits.

Electrical ABR (EABR) and Triggering Instructions for AEP

* - refers to directions specifically related to Cochlear Corporation software, however, EABR should work with all cochlear implant manufacturers (Advanced Bionics & Med-El).

In order to perform Electrical Auditory Brainstem Response (EABR) with the Bio-logic Nav Pro system, you will need the following hardware:

- 1 trigger cable part #304100
- 1 RF filter part #405000
- 3 jumper cables part #301003

Cable to interface between the Bio-logic Trigger cable and the Cochlear Implant software box. The components for this cable may be purchased at an electronics supply store, such as Radio Shack®. You will need 1/8-inch stereo jack end to go into Trigger cable and 1/8-inch mono jack end to go into Cochlear box or BNC end to go into Advanced Bionics box.

Protocol Setup

1. Connect Trigger cable from cochlear implant device to Bio-logic Navigator Pro system. This cable connects to the green connector (5V TTL) on the Nav Pro box. The default ending on this cable may not be compatible with the connection needed for a particular cochlear implant manufacturer. In this case, the customer will need to purchase an adapter and/or modify the ending themselves. Adapters can be purchased at an electronics supply store, such as Radio Shack. The Trigger cable has two ends, use the small female end "Trigger In."
2. Read RF filter section of this document for instructions on how to attach the electrodes in the patient cable to the RF filter.
3. If you do not have an EABR protocol, Select ABR (1 channel 10.66 ms) protocol list.
4. Modify the following parameters in Protocol
 - a. Under Recording Parameters – modify epoch to 5.33 msec
 - b. Under Stimulus Parameters – Select Trigger In
 - c. Under Amplifier Parameters –
 - i. Change High Filter to 3000 Hz
 - ii. Turn Off Electrode Switching
 - iii. Modify Tag – Click Edit Tag and select User Text, type in EABR
 - d. Select Save As to save protocol and rename as EABR.
5. Read the section of this document on Electrical ABR Tips for parameters to use. Many customers use standard 100 to 3000 Hz filters successfully. However, if experiencing problems modify filters as recommended.
6. **Begin by delivering stimulus to the implant first and then select Record in AEP software.** If you start AEP first, you may get an error message "Test Time Alert." "Prolonged test time suggests the patient state and/or other test conditions are poor at this time. Consider trying again later."

Note:

1. **A body-worn processor must be used to perform EABRs. *BTE processors are not functional with Neural Response Telemetry (NRT) or compliance telemetry.**
2. **It is advised that you use a spare processor to perform NRT or EABR because the programming will be erased and will need to be reprogrammed after the NRT or EABR are performed.**
3. **Use the NRT software to perform the EABR. The NRT software generates the current level through the implant that will stimulate the cochlea, generating the EABR.**
4. **The EABR waveform will appear on the Bio-logic collection screen. You will only see a flat dashed line on the NRT software.**

Electrical ABR Tips

- Use short pulse widths (100 microsecond is usually acceptable).
- Set the number of sweeps on the Bio-logic® system 100 sweeps below what is set on the cochlear implant software. (eg: Bio-logic = 900 sweeps and cochlear implant software = 1000 sweeps). The Bio-logic software will stop collecting first and then the cochlear implant will stop. *On Cochlear Corporation software setting the NRT to 1000 sweeps actually equals 2000 sweeps (1000 negative polarity and 1000 positive polarity).
- Set the repetition rate in the cochlear implant software reasonably low (13-33 Hz) to permit a high stimulus current without exceeding comfort level.
The rate should not be a sub-multiple of the power line frequency, as this will aggravate collection problems. For example, in the U.S., where the power line frequency is 60 Hz, one should never use 10, 12, 15, 20, or 30 Hz repetition rate. It's usually safe to pick an "oddball" rate like 13 Hz or 27 Hz.
- There is a startup pulse in the cochlear implant device that occurs at 6 ms, other devices may vary. If you use a 10msec time window you will see a large artifact at the end of the recording. Change the time window size to 5.33 ms and the recording will look cleaner without the artifact.
- The filters on the recording amplifier should be as wide as possible to allow it to recover rapidly from the stimulus artifact. A band pass of 10 Hz-20 Hz is acceptable, but 3 Hz-40 kHz is better.
- To reduce artifact, collect the contralateral recording only.
The electrode montage is as follows: Channel 1 Input 1 = vertex or high forehead, Channel 1 Input 2 = contralateral mastoid or earlobe, Common = any placement far from the implant side.
- If the amplifier doesn't recover quickly enough from the artifact even when the filters are wide open, it may help to reduce the gain.
The gain should be kept at 50,000 or less.
- Start with a narrow apical bipolar electrode pair (Ex. 22 BP or BP + 1). Responses will often be stronger when stimulating in the Apical region. Artifacts will be much smaller with bipolar than monopolar stimulation.
- Be suspicious of odd-looking waveforms. The wave IV/V complex should peak at around 4.5 ms and should be no bigger than 1 microvolt. Anything that is bigger or increases in amplitude along with the stimulus amplitude is probably EMG caused by facial nerve stimulation.

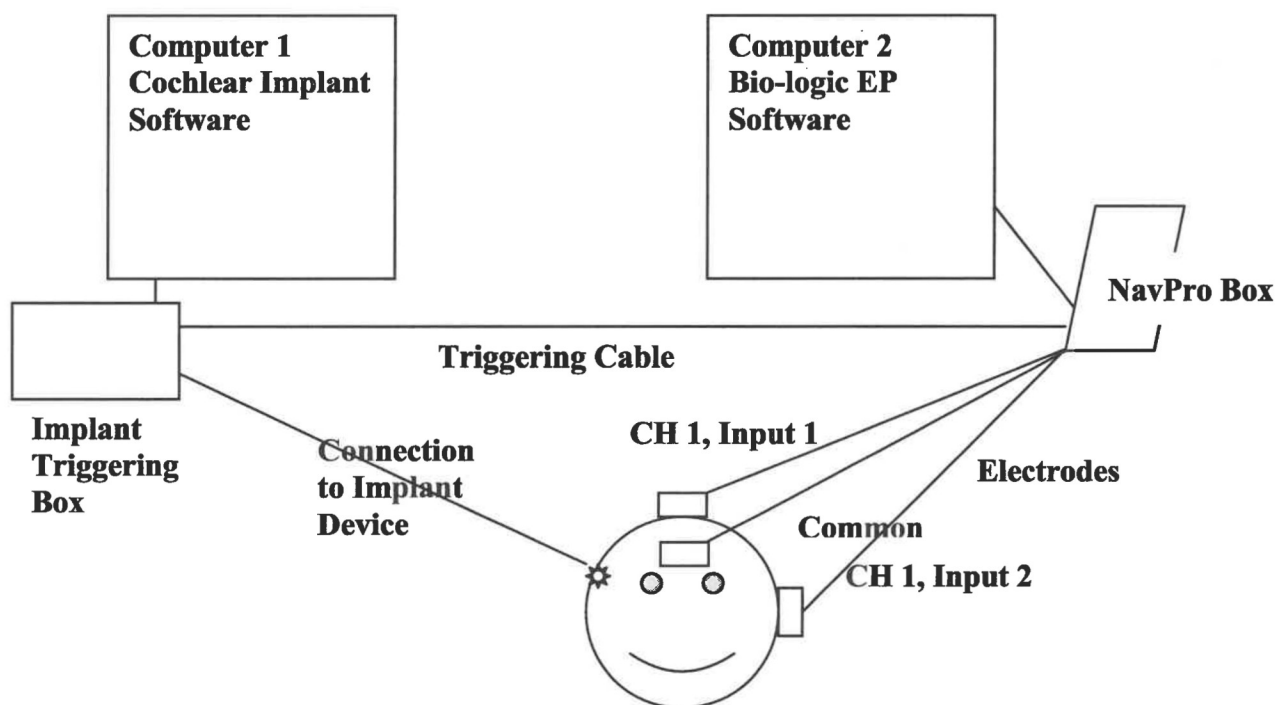
RF FILTER

The Bio-logic RF filter is a two channel filtering device designed to eliminate unwanted high frequency signals often present in EABR or in evoked potentials performed in the operating room. The RF filter, when placed between the patient and the Bio-logic patient cable, eliminates artifact through the use of a 34 kHz low pass filter.

To connect the RF filter to the evoked potential system: On the top of the RF filter are two areas, one labeled Patient Connection and the other labeled System Connection. Plug the electrode leads from the patient into the appropriate inputs on the RF filter Patient Connection. Place one jumper cable in each corresponding input of the System Connection. Connect the other end of the jumper cable to the corresponding input of the Bio-logic patient cable.

*Cochlear (Nucleus) Software version R126

- For the Pulse in the RF Blanking change from 6000 to 10,000.
- Select EABR on the Main screen, then click 'More' button and make the Paradigm = Alternating. This feature is enabled in the Research Mode only.
- Directions on how to access the research mode must be obtained from Cochlear Corp. (800-523-5798).



Electroneuronography



CAUTION

The Digitimer manual should be fully read and understood before use of this product, including the Precautions and Warnings section.

MISE EN GARDE

Le manuel du Digitimer doit être entièrement lu et compris avant l'utilisation du produit, y compris les paragraphes sur les Précautions et les Avertissements.

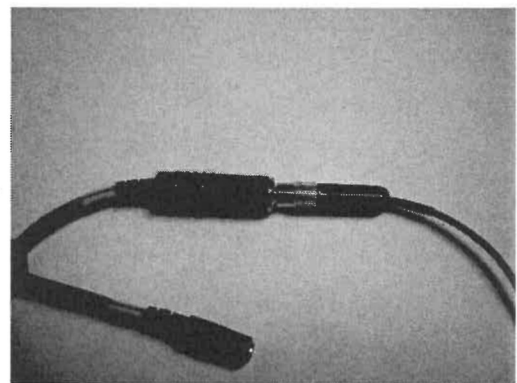
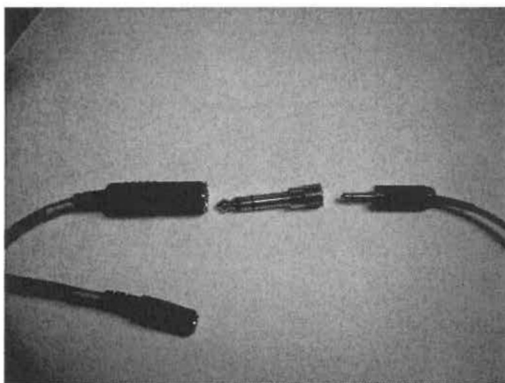
The Digitimer High Voltage Stimulator model DS7A provides constant current high voltage pulses of brief duration for percutaneous stimulation during investigation of the electrical activity of nerve and muscle tissue. The output current is continuously variable over the range 0 to 100 milli-Amps, from a source voltage continuously variable from less than 100 Volts to 400 Volts, to meet the requirements of human pathological cases. Short pulse durations have been made available to minimize any discomfort to the subject. The pulse duration can be varied from 50 microseconds to 2 milli-seconds in six steps and a specially designed isolated output stage maintains a square (current) pulse shape while minimizing stimulus artifacts. The instrument is mounted in a non-conductive, free-standing case and is mainline powered.

ENOG/SEP Package Includes:

Digitimer SEP Stimulator – 585-STDS7A
Digitimer Stimulus Cable – 541-HB4CBL
Strobe Out Cable – 580-STRB04
NavPro Trigger Cable – 541-NAV04
Mini-phono to standard phono adapter – 531-ADAP13
2 Bar Electrodes - 101803
2 Handles for the Bar Electrodes - 101898

Connecting your NavPro to the Digitimer

- Connect the mini phono to standard phono adapter to the end of the Strobe Out cable first (this is tight) then connect it into the Trigger Out end of the Bio-logic Trigger Cable.

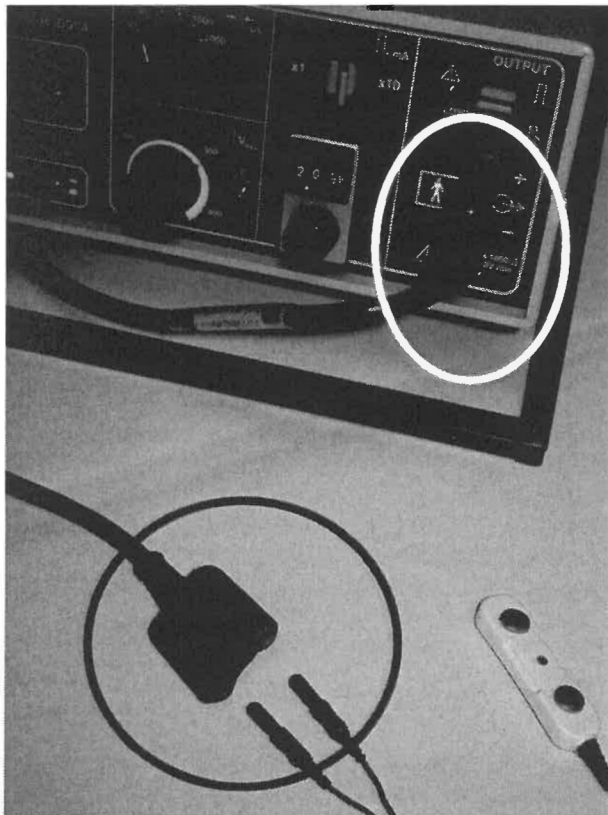


Electroneuronography

- Connect the Trigger cable (green din connector) into the NavPro and the Stobe out cable (BNC connector) into the Trigger In on the back of the external stimulator (Digitimer).



- As shown below, connect the red and black connectors from the stimulus electrode cable to the Digitimer stimulus cable (black circle below). Then connect the other end of the Digitimer stimulus cable into the Digitimer unit matching the red to red and black to black (white oval below). Also supplied is a handle that snaps onto the stimulus electrode bar.



Electroneuronography

Stimulus parameters on the Digitimer



- Dials and switches are numbered above in the picture.
- 1. This is the power on switch. Push the button to turn on. When the power is on the green light will be illuminated.
- 2. This dial is the constant current duration of the continuous electrical pulse – set this dial to 200 microseconds.
- 3. This dial is the maximum voltage amplitude setting assuming skin impedance at the stimulation site is low. This dial should be set at 300 volts.
- 4. This switch determines the graduated steps of the milliamp dial below it. If the switch is set to x1 and the dial is set to 1.2, this is 1.2 milliamps. If the switch is set to x10 and the dial is set to 1.2, this is 12 milliamps. The recommended setting for electroneuronography is x10.
- 5. This dial determines the milliamps being delivered via the stimulus electrode. Start at a very low number and ascend.
- 6. **IMPORTANT!!** This is the Output Enable or Reset switch. If the red light is on, the Digitimer will not deliver a pulse. Reset the unit by flipping this switch down (off) and then back up (on). The red light near this switch should not be on.
- 7. This button is the trigger button and when pushed sends an electrical pulse to the stimulus electrode. Use this button to test the Digitimer unit. Make sure you are at a low level on the milliamp dial (#5 above), then press the button while holding the electrode to ensure you are delivering a stimulus. This is not used during collection. The amber light next to this button will illuminate when a stimulus is being delivered.

Electroneuronography

ENOG Protocol

This protocol is setup for a collection of one sample of facial nerve evoked potential activity at supramaximal stimulation level. Alternatively you can set the maximum number of averages to 5. If an ENOG protocol does not already exist in AEP, please make the following modifications to the AEP: ABR (1 Channel, 21.33 ms window) Protocol and save as "ENOG (1 Channel, 21.33 ms window)". The underlined parameters below are the ones that must be modified. Use User Text option to modify the sample tag (See Edit Tag Setup display section of the manual). For the label set start with the VEMP protocol and edit it and save as "ENOG"

ENOG (1 Channel, 21.33 ms window)

General Protocol Parameters			
Test Type:	AEP	Default:	No
Label Set Name:	ENOG	Manufacturer (cannot delete):	No

Recording Parameters			
Epoch Time(ms):	21.33	Bayesian Weighting:	N/A
Number of Points:	256	Blocking (ms):	<u>2.60</u>
Maximum # of Averages:	<u>1</u>	Pre-Post Time(ms):	0.00
Noise Level Stop Criterion:	OFF	FSP Auto-stop Level:	OFF
Fsp Epoch Start(ms):	OFF	Fsp Epoch Stop(ms):	OFF
FSP Skipped Points:	N/A	FSP Total Points:	N/A
Save Impedance Test Values:	ON		

Stimulus Parameters			
Transducer	Insert Earphones	Insert Delay(ms):	0.80
Ear	Right	Stim Rate(per sec):	1.10
Polarity:	Rarefaction	Trigger In:	OFF
Intensity:	80 dB nHL	Intensity Step:	5
Continuous Stimulus:	ON	Trigger Out Pulse:	<u>ON</u>
Stimulus Type Dependent Values:			
Stimulus Type:	Click	Frequency(Hz):	N/A
Click Duration(uSec):	100	Ramp:	N/A
Plateau:	N/A	Rise/Fall(cycle):	N/A
WAV File:	N/A		
Masking Parameters:			
Masking Type:	None	Masking Intensity:	N/A
Masking Transducer:	N/A	Mask Level Link:	N/A

Amplifier Parameters			
Channel Number:	Channel 1:	Channel 2:	
Enable:	ON	OFF	
Gain:	<u>1000</u>	N/A	
Artifact Reject(uV):	OFF	N/A	
Low Filter(Hz):	<u>3.00</u>	N/A	
High Filter(Hz):	<u>1500</u>	N/A	
Notch Filter:	OFF	N/A	
Input 1:	Xipsi	N/A	
Input 2:	Yipsi	N/A	
Sample Tag:	<u>REN OG</u>	N/A	
Electrode Switching:	<u>OFF</u>		

ENOG

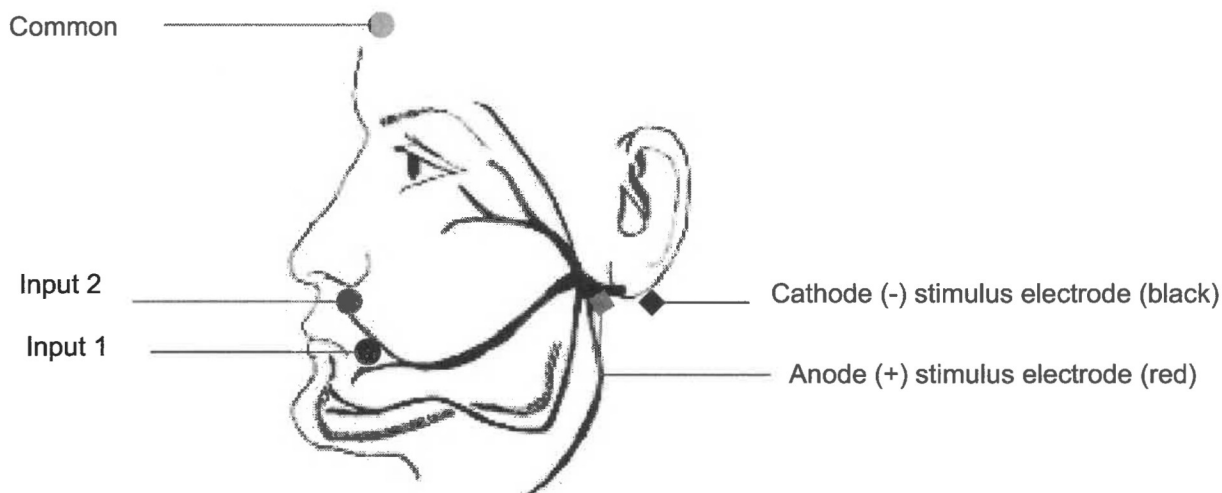
Labels		Calculations		Ratios
L1	N1	C1	N1 - P1	
L2	P1	C2	P1 - N2	
L3	N2			
L4	P2			
L5				
L6				
L7				
L8				
L9				
L10				

Patient Preparation

The skin at both the stimulus and recording electrodes sites should be prepped to achieve low impedance. The Common (ground) is the forehead. Low ($\leq 5 \text{ kOhm}$) and balanced (within 2 kOhm) recording electrode impedance is required. Prep of the stimulus site will reduce the discomfort of the electrical pulse to the patient. The stimulus site is all around the base of the mastoid and in front of the ear lobe. Wipe off the prep so that you do not create a salt bridge. A salt bridge can result in loss of energy due to the stimulus moving between electrodes instead of thru the skin to the nerve.

Electrode Montage

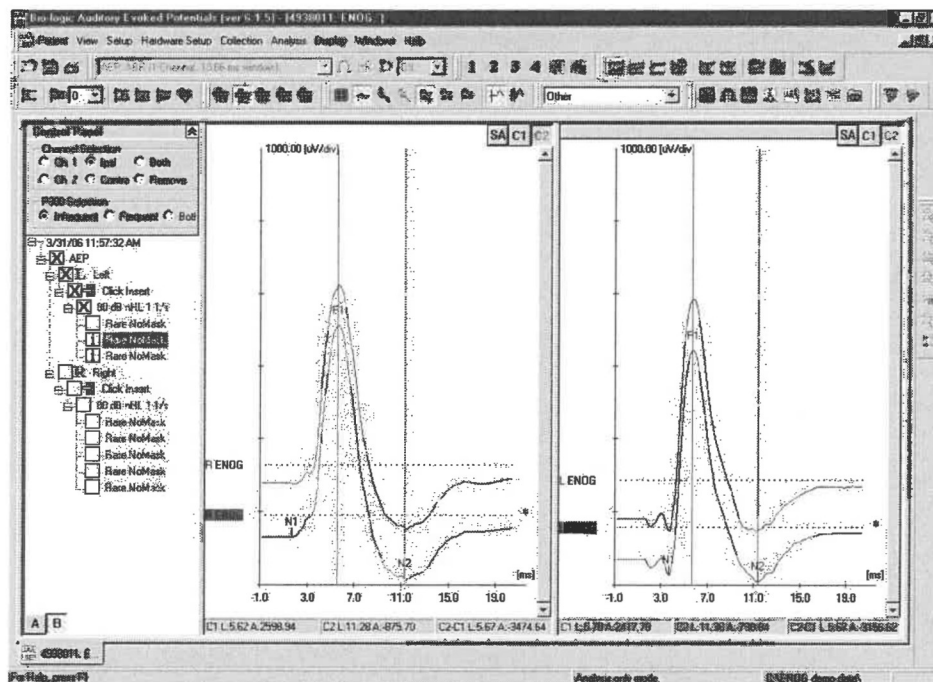
The usual recording site is Input 1 (active) is the corner of the mouth and Input 2 (reference) is the corner of the nose.



Electroneuronography

Collecting Data

- Set the Specific Scale to 1000 nV (See Set Display Scale section in AEP manual).
- Start the collection in View EEG Only mode. The response can be viewed in the EEG window which assists you in identifying when you have placed the stimulus electrode in the proper location.
- Place a small amount of gel on the gold disks of the stimulus electrode and set the milliamp dial to a low level (0.3 on the dial equivalent to 13 milliamps). Position the stimulus electrode around the mastoid with the cathode (black) behind the earlobe and the anode (red) in front.
- Begin turning the milliamp dial up while looking at the patient's face for a visible twitch at the corner of the mouth and observing the EEG window in the software for a response. Finding the correct stimulus electrode placement is the most challenging part of the test. You will have to reposition the stimulus electrode and adjust the intensity until you achieve a twitch at the corner of the mouth (not just a twitch of the eye). Once the correct position is found mark the location of the Anode and Cathode with a grease pencil.
- Select the Stop button in the AEP software to terminate viewing of the EEG and the stimulus delivery.
- Prepare the patient for the larger stimulus. The patient needs to be instructed that the test will involve a bigger stimulus and they will feel several of these intense pulses during collection.
- Reposition the stimulus electrode on your markings. Adjust the intensity of the stimulus to supramaximal level (usually between 20-40 mA). Click on the Record button in the AEP software to start collection.
- Repeat the steps for the other side of the face.
- On the waveform panels view the trials for each side and mark the N1, P1 and N2. Side to side amplitude assymetry is the major diagnostic indicator of unilateral weakness.
- **CPT Code for Electroneuronography is 92516**



DETAILED TESTING PROCEDURES

This section presents illustrated, detailed testing procedures for the AEP system. Please read these procedures carefully. Bio-logic Systems Corp suggests that you follow them in order whenever you run a test. If this document does not answer any question that arises, contact Bio-logic Systems Corp Customer Service at 1-800-272-8075 or 1-847-949-5200.



CAUTION

This system is intended for use as a medical instrument only. The software installed on this system has been verified and validated for that use, as long as no other unintended or unauthorized software is installed and running at the same time. Do not install, download, save, or transfer other programs, software, or data on this equipment without first consulting Bio-logic Systems Corp. Doing so may interfere with the proper operation of this software.

MISE EN GARDE

Cet appareil est conçu pour être utilisé comme instrument médical seulement. Le logiciel installé dans l'appareil a été vérifié et validé pour cette utilisation, pourvu qu'il n'y ait aucun autre logiciel non autorisé fonctionnant en même temps. Aucun téléchargement ou transfert ni aucune installation ou sauvegarde d'autres programmes, de logiciels ou de données ne doit être entrepris sur cet appareil sans avoir préalablement consulté Bio-logic Systems Corp. De telles opérations pourraient interférer avec le fonctionnement de ce logiciel.

Starting the AEP program

To start the AEP program, follow these steps:

1. Activate the computer and wait until the Windows "Desktop" screen appears.

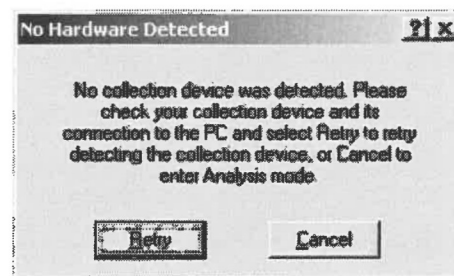


2. Select (click on) the AEP shortcut icon  to start the program.
When the software loads, it searches for associated hardware, initializes the Navigator Pro® unit, and displays the first screen of the AEP program.

OR

3. Select (click on) the Start button on the Windows task bar.
A menu of program items appears.
4. Select (click on) the Programs menu item.
A list of the applications on your computer appears.
5. Find and select (click on) Bio-logic Systems Corp, then AEP.

If the AEP application and its associated hardware cannot communicate and an error message appears, follow these steps:



6. Make sure that the Navigator Pro module is powered ON.
7. Verify that the USB or serial cable connects securely to both the Navigator Pro module and to the computer.

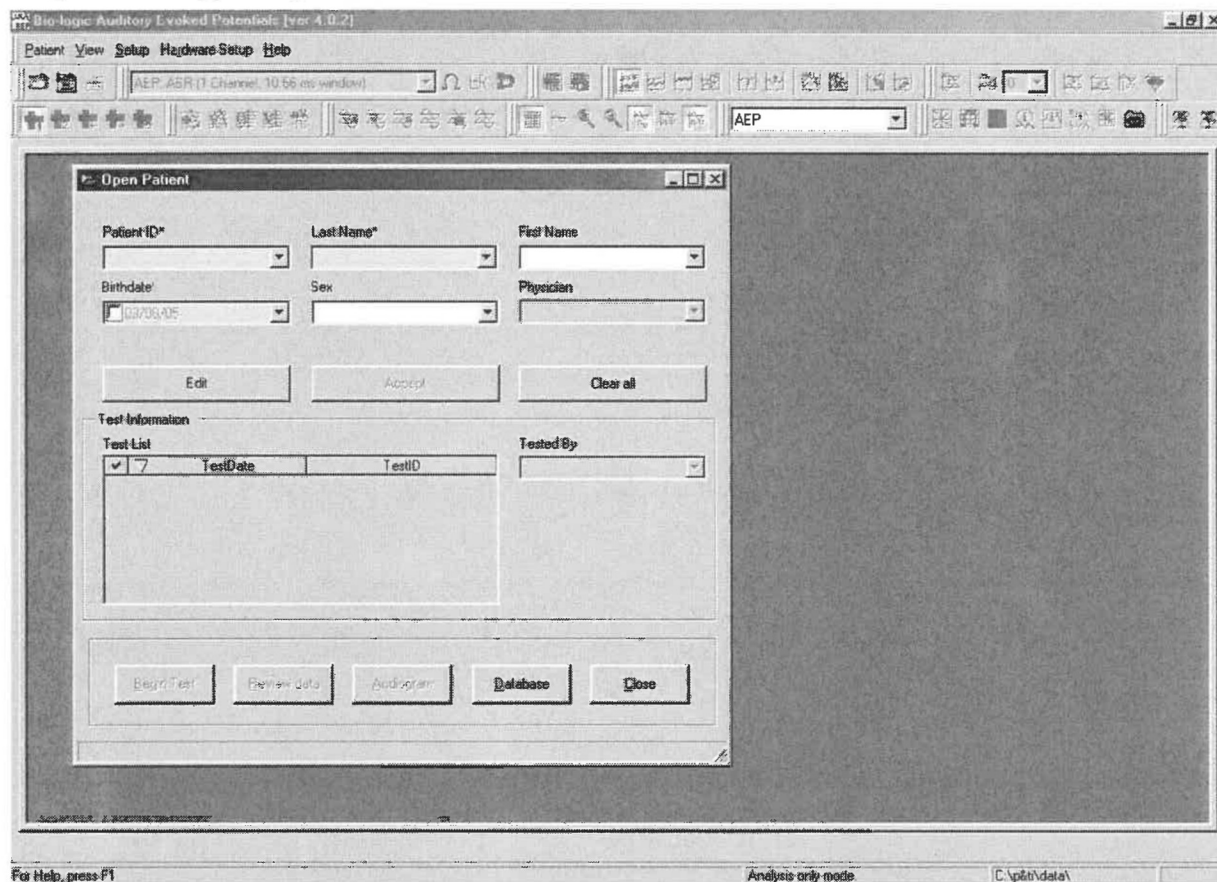
When the power is on, a status message appears on the LCD screen and a green light appears on the front panel of the Navigator Pro® module. If the module is not powered ON:

- Verify that the isolation transformer is on. The "I" should be pushed in.
- Check the connection between the isolation transformer and its power cable to the wall outlet.
- Check the plug connection into the isolation transformer.
- Check the connection between the power supply and the power cable.
- Check the cable connection into the power connector on the left side of the Navigator Pro module.
- Verify that the wall outlet is working correctly.

8. Select the Retry option.
9. Click on Hardware Setup and select Enable Hardware in AEP software.

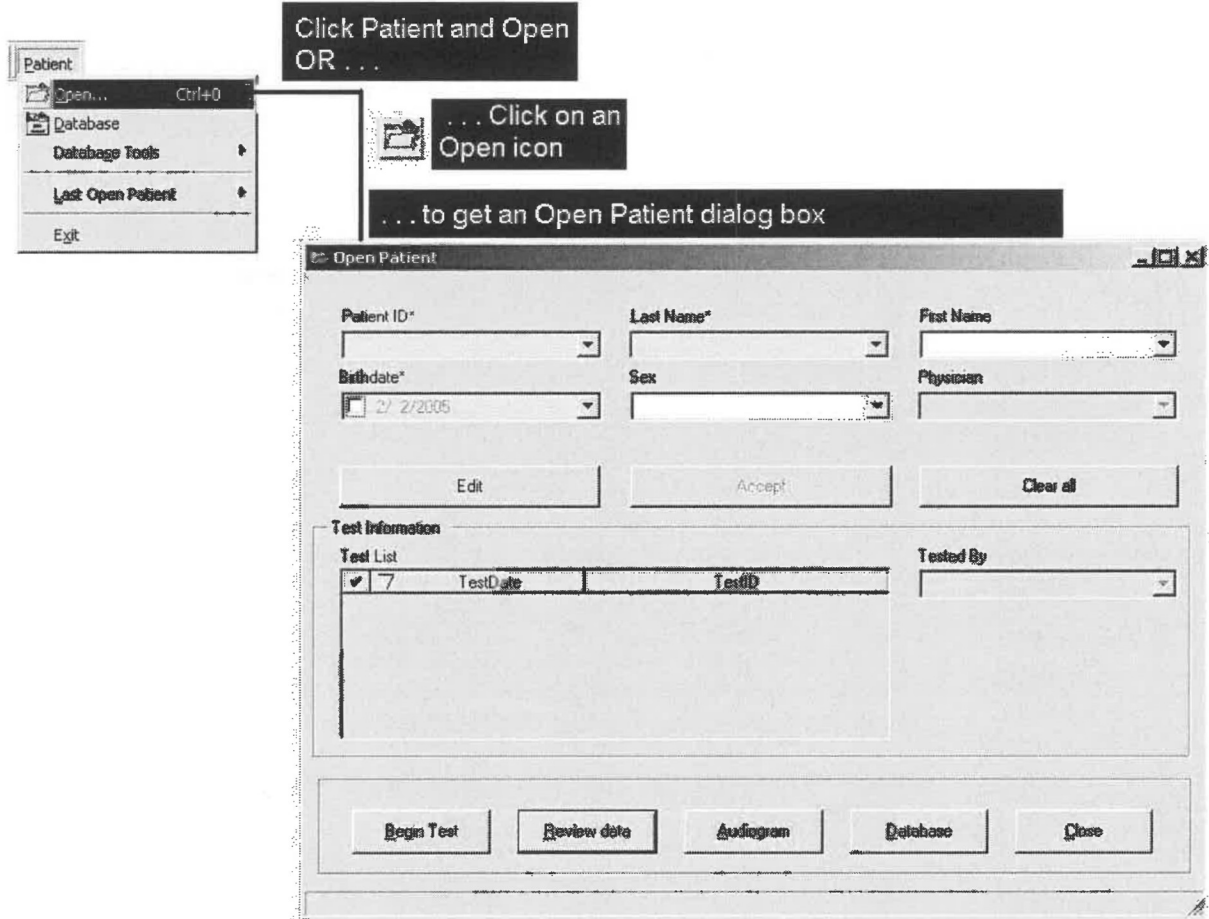
If the same error message appears, call Bio-logic Systems Corp Customer Support for troubleshooting assistance.

Opening a patient file



When you open the AEP program with the Navigator Pro® module connected, the software automatically displays the Open Patient window. You can then use that window to open an existing patient file or create a new patient file.

Note: Patient ID, Last Name, and Birthdate are the default required fields that must be entered to proceed with data collection. All other fields are optional unless modifications have been made in the P&TI Embedded Setup.



Note: This screen appears automatically when users first initialize the program with the Navigator Pro® module connected.

Component	Description
The Patient ID field	Contains a drop-down list of identification numbers for the patients in the Patient and Test Information (P&TI) database. You can select an ID number from that list, or type in a new ID number. This is a required field. Note: You must have a unique ID for each patient. The ID can be comprised of numbers, letters, or both.
The Last Name field	Contains a drop-down list of last names (surnames) for the patients in the P&TI database. You can select a last name from that list or type in a new last name. This is a required field.
First Name field	Contains a drop-down list of first names for the patients in the AEP test database. You can select a name from that list or type in a new name.

DETAILED TESTING PROCEDURES

Click this box to activate (checkmark) the field

Click the arrow in the Sex field to select the patient's gender

Type the date you want in this field OR ...

... Use the calendar tool to set the date you want

Birthdate*

☒ 4/30/2005

Sex

Female

Male

Accept

Physician

Clear all

TestID

Tested By

Component	Description
Birthdate checkbox and data entry field	Select (click on) this checkbox until a checkmark appears to activate the field. You can then use the field to confirm or edit the birthdate or select (click on) the drop-down arrow to display a calendar. This is a required field. Note: You must enter the correct birthdate to use the GraphMaster normative data.
Sex designation field	Choose the option that designates the patient's gender.
Physician field	Lists the names of the physician in the P&TI database. You can select a name from that list or add a new name. To create a list of physicians see Patient Setup – Lists section. Note: You must first click Accept or Edit to activate this field.

DETAILED TESTING PROCEDURES

Test Information

Test List

	TestDate	TestID
☒	11/18/2004 8:40:30 AM	EP00004
☐	8/25/2004 3:14:00 PM	EP00003
☐	8/23/2004 2:16:26 PM	EP00002
☐	8/10/2004 11:52:21 AM	EP00001

Tested By: ↓

Click on these boxes to select existing data to review or combine with new data

Click on this arrow to get a list of testers; choose the tester you want from the list

Component	Description
Edit command button	Edits the information in individual fields without changing information in any of the other fields.
Accept command button	Saves edited or new patient information and activates the Physician and Tested By fields and Begin Test and Review Data command buttons.
Search again/Clear all command button	Clears all patient information in the Open Patient Dialog box.
Test List information area	Lists the various test sessions by date that apply to the patient you have selected. It is blank for a new patient or for patients in the database who have not yet had an AEP test performed. This information includes the date and time each test was run and the individual ID number for each test.
Tested By display field	List of names of the individuals who perform AEP tests. You can select from the list or type in new tester names. To create a list of tester names see Patient Setup – Lists section. Note: You must first click Accept in order to activate this field.

DETAILED TESTING PROCEDURES

Test List		Tested By
☒	7	
☒	11/18/2004 8:40:30 AM	EP00004
☐	8/25/2004 3:14:00 PM	EP00003
☐	8/23/2004 2:16:26 PM	EP00002
☐	8/10/2004 11:52:21 AM	EP00001

Begin Test
Review data
Audiogram
Database
Close

Component	Description	
Command buttons	This set of command buttons helps you control the AEP test. Functions include:	
	Begin Test command button	Allows user to begin data collection.
	Review Data command button	Allows user to review previously collected data. You must checkmark at least one test in the Test Information list to activate this command button.
	Audiogram command button	Enter the audiogram for the patient you want to test. Only the last audiogram entered will be saved. The software does not store multiple audiograms. Note: The most recent audiogram must be entered for Stacked ABR to calculate the interaural difference.
	Database command button	If patient information is entered in the Open Patient Dialog box, you can enter additional patient information under the patient info tab. If patient information fields are empty, a table view display appears and you can select a patient from a list.
	Close command button	Closes the Open Patient dialog box.

Database – Patient Info

Bio-logic Patient & Test Information - [ver. 4.0.2]

File Edit View Goto Help

Location AEP

Patient Info | Test Info | Test Results

Patient ID: 013104 Last Name: Test First Name: Birthdate: 1/31/2005 Sex:

Physician: Gestational Age at Birth in Weeks:

Address1:

Address2:

City: State: Postal Code:

Telephone:

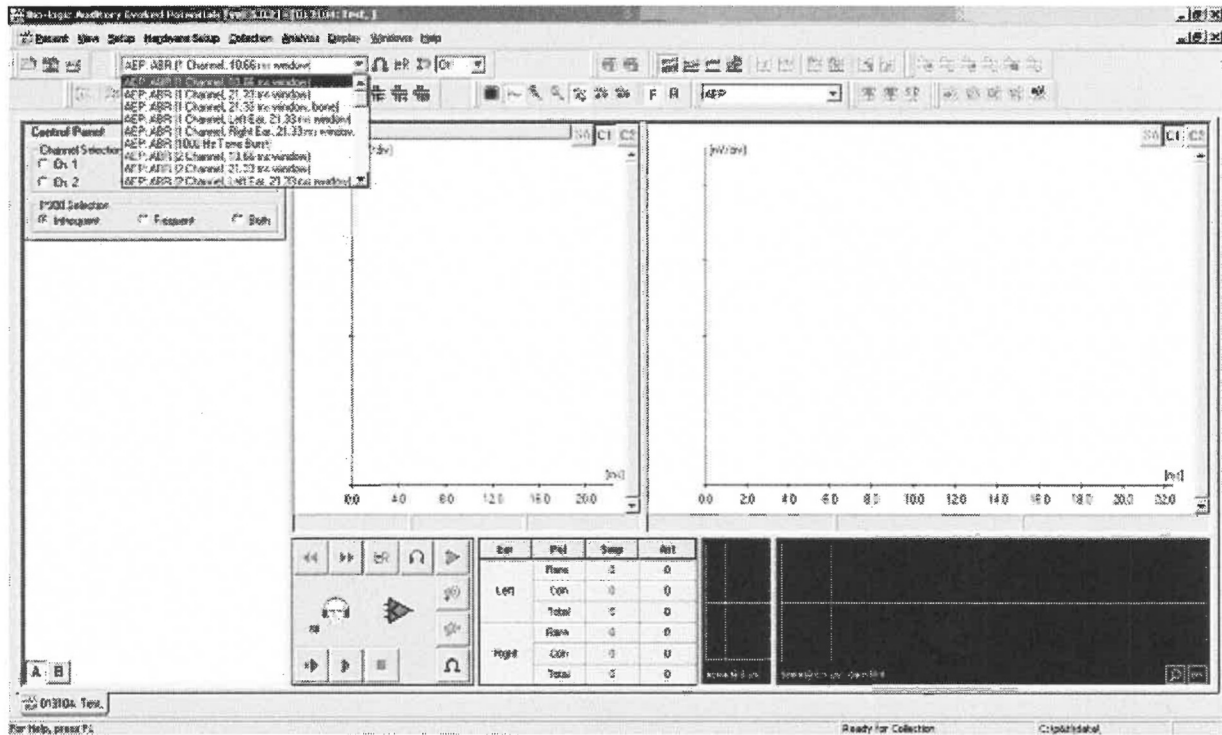
History:

Click the Database button to view the Patient Info tab. Enter additional patient information in the Patient Info Tab. If you enter Gestational Age at Birth in Weeks, the program takes this value into account with the GraphMaster normative data.

To close, click on the “x” in the top right corner of this window.

Protocols

Begin data collection

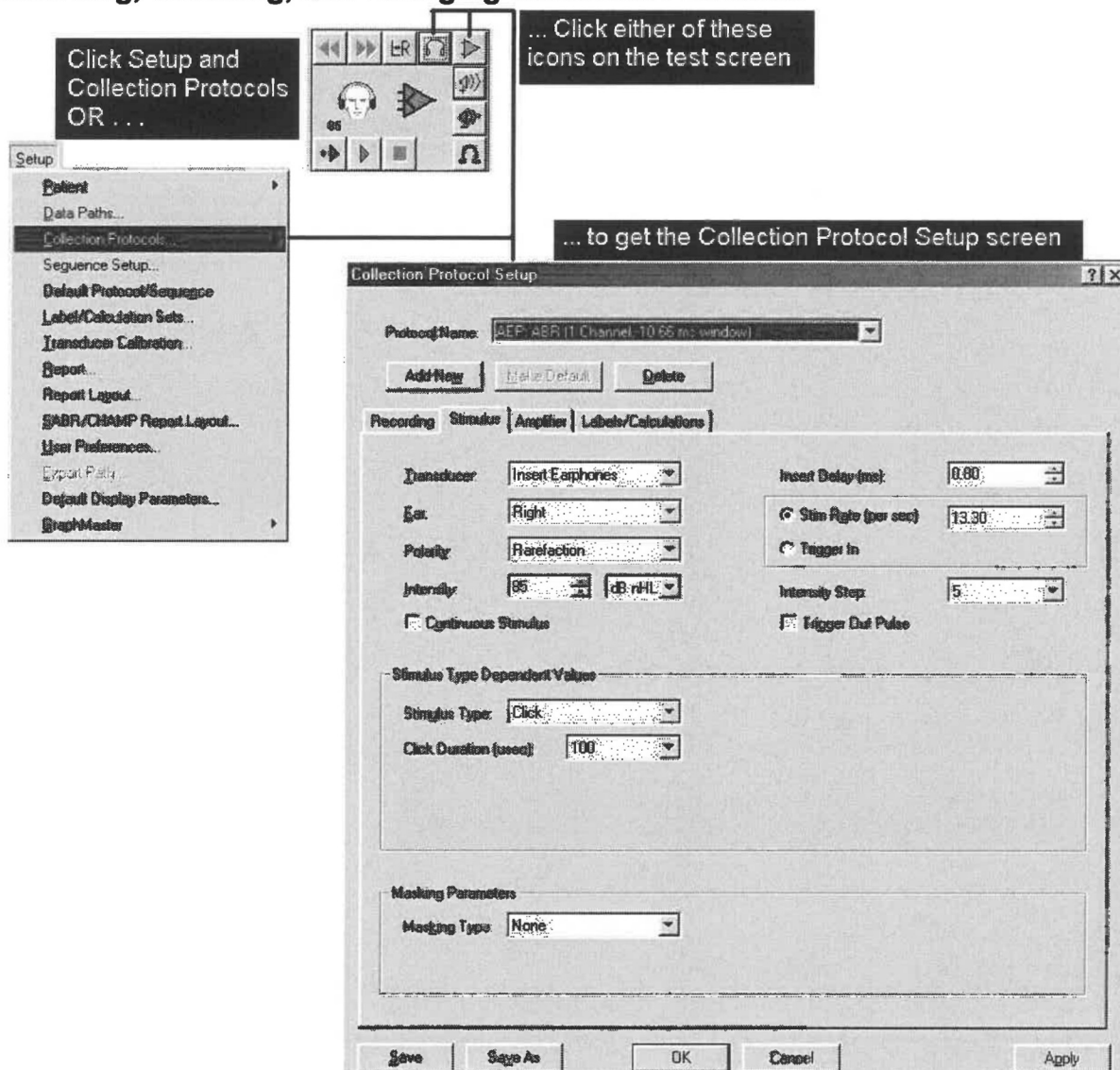


After completing the required fields in Open Patient window and selecting “Begin Test”, data collection can proceed.

Select a protocol from the drop down list. You only have access to protocols that your hardware supports (eg: you will not have P300 protocols unless you purchased P300).

	CAUTION Protocol settings, data fields and controls are typically optimized for the various protocols during installation. Only trained and experienced users should change these settings. To create a new protocol, we recommend that you start with the protocol that is most similar to what you want. Bio-logic Systems Corp assumes no responsibility for any problems that may arise from improper use.	MISE EN GARDE Les paramètres de protocole et les champs de données et de contrôles sont spécifiquement optimisés pour les différents protocoles pendant l'installation. Seuls des utilisateurs qualifiés et expérimentés devraient changer ces paramètres. Pour créer un nouveau protocole, nous vous recommandons de commencez par le protocole qui est le plus proche de ce que désirez. Bio-logic Systems Corp n'assume aucune responsabilité pour des problèmes qui pourraient d'écouler d'une utilisation inappropriée.
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Selecting, Checking, and Changing Collection Protocols



Recommendation:

To create a New Protocol, start with the protocol that is most similar and edit it until it meets your needs. Before making changes, click on Save As and enter a new name for your new protocol so that the default protocol doesn't accidentally become overwritten.

DETAILED TESTING PROCEDURES

Click this arrow to get a list of protocols;
Choose the protocol you want from the list.

The screenshot shows the 'Collection Protocol Setup' dialog box. At the top, the 'Protocol Name' field is set to 'AEP: ABR (1 Channel, 10.66 ms window)'. Below this are three buttons: 'Add New', 'Make Default', and 'Delete'. A callout points to the 'Add New' button with the text 'Click Add New button to launch a New Protocol dialog box'. Below the buttons are four tabs: 'Recording', 'Stimulus', 'Amplifier', and 'Labels/Calculations'. A callout points to the 'Recording' tab with the text 'Click on setup tab you want'. The 'Recording' tab is active, showing a 'Test Type' of 'AEP' and a 'Channel 1' plot area. To the right of the plot are various parameters: 'Epoch Time (ms)' set to 10.66, '# Points' set to 256, 'Pre/Post Time' set to 0.0 ms, 'Blocking' set to 1.3 ms, 'Maximum # of Averages' set to 2048, and checkboxes for 'Save Impedance Test Values', 'Noise level stop criterion' (set to 5 nV), and 'Fsp Calculation'. The 'Fsp Calculation' section includes 'Epoch Start (ms)' and 'Epoch Stop (ms)' both set to 0.0, 'FSP Skipped Points' set to 0, 'Total FSP Points' set to N/A, and 'FSP Auto-stop level' set to 0.0. At the bottom are five buttons: 'Save', 'Save As', 'OK', 'Cancel', and 'Apply'. A callout points to these buttons with the text 'Click Delete button to delete the protocol you select from the Protocol Name field'. Another callout points to the 'Make Default' button with the text 'Click Make Default button to set the protocol you select from the Protocol Name field as the default protocol'. A final callout at the bottom points to the bottom buttons with the text 'Use these command buttons with all of the protocol setup tabs'.

Click Add New button to launch a New Protocol dialog box

Click on setup tab you want

Click Make Default button to set the protocol you select from the Protocol Name field as the default protocol

Click Delete button to delete the protocol you select from the Protocol Name field

Use these command buttons with all of the protocol setup tabs

Component	Description
Protocol Name field	Lists the names of the protocols that exist in the AEP system, in alphabetical order.
Add New command button	Creates a new protocol under a new name.
Make Default command button	Makes the currently selected protocol, the default protocol whenever you launch the application.
Delete command button	Removes any protocol you choose from the protocol list. Some protocols cannot be deleted.
Recording tab	Displays the Recording parameters.
Stimulus tab	Displays the Stimulus parameters.

Component	Description
Amplifier tab	Displays the Amplifier parameters.
Labels/Calculations tab	Displays the Labels/Calculations for that protocol.
Save command button	Saves changes made to the protocol permanently. It is best to save new protocols under a new name so that you can refer back to the manufacturer default protocols if needed.
Save As command button	Saves any changes made to a protocol to a new protocol name. The program retains the original protocol with its original parameters.
OK command button	Closes the Collection Protocol Setup screen and implements any changes you have made. The program uses these changes for subsequent tests in the session. To save them permanently, you must use the Save or Save As commands.
Cancel command button	Closes the Collection Protocol Setup screen without implementing any changes.
Apply command button	Applies any changes to the protocol you have selected or are creating but leaves the dialog box open.. The program uses these changes for subsequent tests in the session. To save them permanently, use the Save or Save As commands.

Recording tab

Collection Protocol Setup

Protocol Name: AEP: ABR (1 Channel, 10.66 ms window)

Add New Make Default Delete

Recording Stimulus Amplifier Labels/Calculations

Test Type: AEP

Channel 1

Epoch Time [ms]: 10.66 # Points: 256

Pref/Post Time: 0.0 ms

Blocking: 1.3 ms

Maximum # of Averages: 2048

☒ Save Impedance Test Values

☒ Noise level stop criterion

5 nV

☒ Fsp Calculation

Epoch Start (ms): 0.0

Epoch Stop (ms): 0.0

FSP Skipped Points: 0 N/A ms

Total FSP Points: N/A

☐ FSP Auto-stop level: 0.0

Scale: 5 uV Gain: 100000

Save Save As OK Cancel Apply

Click this arrow to get a list of protocols;
Choose the protocol you want from the list.

Use these command buttons with all of the protocol tabs

DETAILED TESTING PROCEDURES

Component	Description
Epoch Time (ms) field	Select the desired epoch time for the recording window in milliseconds (ms).
# Points field	Sets the number of points (samples) in the epoch (recording window).
Pre/Post Time slide control	Determines the start of the epoch relative to stimulus onset. By entering a non-zero millisecond (ms) value in the Pre/Post time, you can start the collection before or after the stimulus is delivered. Negative values begin the epoch prior to stimulus onset. Positive values begin the epoch after stimulus onset. An entry of zero (0) starts the epoch at the onset of the stimulus.
Blocking slide control	Blocks high amplitude activity in a portion of the epoch from being counted as an artifact. Typically used to avoid the situation where a large stimulus artifact will cause rejection of the entire epoch.
Maximum # of Averages field and spin buttons	Sets the maximum number of averages you want to include in the recording. The recording will automatically terminate when this number is achieved.
Save Impedance Test Values checkbox	Select (click on) this checkbox until a checkmark appears to save the Impedance Test Values with the recording.
Average only Frequent prior to Infrequent	Option only available in P300 protocol. Results in approximately the same number of averages for frequent and infrequent stimulus sweeps.
Noise level stop criterion checkbox	Select (click on) this checkbox to activate the noise level stop criterion. Use the nV field to set this level. If you want the recording to stop when a noise criterion level is reached make sure you set the maximum number of averages high enough to allow the noise criterion to be achieved. Note: In a 2-channel recording both channels must meet the noise criterion before the recording will stop automatically.
Conditional value radio buttons	Select (click on) one of these radio buttons to specify conditions for stopping the recording per FSP criteria, noise criteria, or both. These radio buttons appear only if checkmarks appear in both the Noise level stop criterion checkbox and the FSP Auto-stop level checkbox.
FSP Calculation checkbox	Select (click on) this checkbox to activate the FSP calculation criteria.
Epoch Start (ms) field	Sets the latency in the epoch where the FSP will begin calculating.
Epoch Stop (ms) field	Sets the latency in the epoch where the FSP will stop calculating.
FSP Skipped Points	Sets the number of points to ignore (skip) within the epoch for the FSP calculation.
Total FSP Points (Read-only)	Total number of points included in the FSP calculation and based on the FSP start, stop and skipped points.
FSP Auto-stop level checkbox and field	Sets the FSP level that must be reached before averaging will stop automatically. If you want the recording to stop when a FSP level is reached be sure to set the maximum number of averages so that it is high enough to allow the FSP to be achieved. Note: In a 2-channel recording both channels must meet the FSP before the recording will stop automatically.
Channel displays	See description under Collecting Data.

Understanding the Sample Rate

The sampling rate is Samples per Second and is determined by the epoch and number of points in the protocol. 48,000 samples per second is the maximum sample rate for the NavPro.

For a 10.66 millisecond epoch and 256 points:

$(\# \text{ points (samples)} * 1000 \text{ ms}) / \text{epoch} = 256,000 / 10.66 = 24000 \text{ Samples per Second}$

For a 10.66 millisecond epoch and 512 points, sampling is twice as fast, because there are twice as many points. $(512 * 1000) / 10.66 = 48,000 \text{ Samples per Second}$

With a longer epoch (21.33 ms) and 256 points, sample is at a lower rate:

$(256 * 1000) / 21.33 = 12000 \text{ Samples per Second}$

Noise Level Stop Criterion and Fsp Calculation

General Information

The AEP software version 3.1.0 and later (only available on the Navigator Pro), offers two new features that can be enabled independently or in tandem during data collection. They are the residual Noise Level Stop Criterion and the Fsp Calculation, a statistic related to an estimate of the signal-to-noise ratio (SNR) and can be used to objectively determine response threshold (see Don et al, 1984). Both the residual Noise Level Stop Criterion and Fsp Calculation provide information about the quality of the ongoing recording of the auditory evoked potential (AEP) and will automatically terminate averaging based on achieving a criterion value. This is in contrast to the more common technique of stopping the averaging based on some arbitrary fixed number of sweeps. For collection protocols that use Fsp calculations or residual noise as the criterion for stopping averaging, you should set the Maximum Number of Averages parameter to a high value in order to give enough time so that the Fsp or Noise criterion value can be met. If the criterion value is not met by the time the application collects the specified Maximum Number of Averages set, then the data collection will terminate.

For both of these procedures, data analysis is performed in blocks of 256 sweep as each block of sweeps is weighted according to the estimated noise in that block of sweeps. This weighting technique (Elberling and Wahlgreen, 1985) minimizes the destructive effects of episodic noise. Those blocks of sweeps having low noise are given more weight in the final average than those blocks of sweeps with high noise levels. This is referred to as Bayesian Weighting and is only in the SABR protocols used for Stacked ABR and CHAMP. In addition, when each block of 256 sweeps is collected, the data is processed to calculate the Fsp or the Residual Noise on the total average up to that point. This means that the time between updates of the average on the waveform panel will be longer since the waves will only update after each set (block) of 256 sweeps.

These functions are only available for AEP and Stacked ABR/CHAMP test type protocols. These functions can be used only if the data collection epoch is 26.67 ms or less and the stimulus rate is 10/sec or greater.

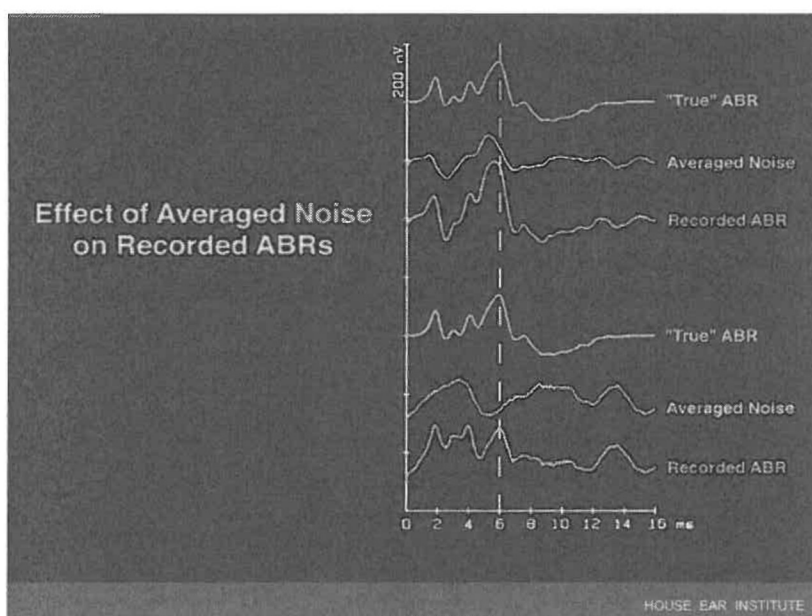
If you are collecting two-channels of data with a stopping criterion based on either Residual Noise or Fsp enabled, the data must reach the criterion value you set in BOTH channels before the collection will stop automatically.

If you enable both the residual Noise Level Stop Criterion and Fsp simultaneously, you must decide whether the criteria must be met for **BOTH** Noise Stopping and Fsp before averaging will stop automatically or if the **OR** condition is sufficient (meets at least one of the criterion values).

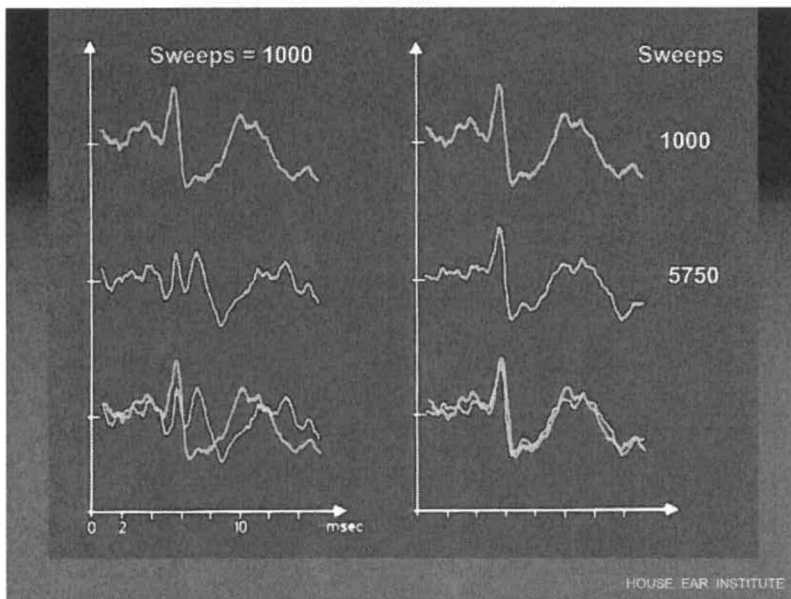
Residual Noise Level Stop Criterion

The residual Noise Level Stop Criterion is a measurement-based stopping function that terminates averaging based on the residual noise in the average (*there may not necessarily be a "response", i.e., an EP in the average*). The benefit of this technique is that it increases the reproducibility of response waves from trial to trial by insuring that each average contains same amount of residual noise rather than the same number of sweeps.

All recorded AEP responses are a combination of true response and averaged noise. The averaged noise can significantly impact the latency and amplitude of the recorded response. Averaged noise can shift the latency and add or subtract from the amplitude of the true response (slide courtesy of Dr. Manuel Don, House Ear Institute and from the work by Elberling, 1985). Look at the top 3 waves below. Note that the peak latency is shorter and the amplitude is increased for the "Recorded ABR" compared to the "True ABR". This occurred due to the contribution of a peak in the "Averaged Noise". Now look at the bottom 3 waves. Note that the amplitude is decreased in the "Recorded ABR" compared to the "True ABR". This occurred due to the contribution of a trough in the "Averaged Noise". You can see that the amount of averaged noise in the recording from trial to trial can significantly alter the look of the recorded response. This explains why recorded AEP responses from trial to trial do not always replicate well unless the residual noise in the average is very small.



It is common practice to collect a certain number of sweeps and replicate the waveforms to verify that there is a true response and that the apparent "response" is not due solely to noise. In the left panel of the graphic below, both responses represent the collection of 1000 sweeps (slide courtesy of Dr. Manuel Don, House Ear Institute and from Elberling and Don, 1984). As described above, often the waveforms do not replicate well because the amount of averaged noise in each trial is not the same. The top trace represents an average of 1000 sweeps and a large EP is evident as the subject was very quiet. The second trace represents a repeat run in this subject where 1000 sweeps are again averaged. However, the average does not replicate well as the subject was much noisier in the second run (see third set of traces). In the right panel, the top trace is the same waveform shown in the top left panel. The second trace represents the average that was terminated when the SNR was the same as in the top trace. That is, when the residual noise reached the same level as estimated in the top trace. Note that in order to obtain the same amount of residual noise, 1000 sweeps were collected for the first averaged response (top trace) and 5750 sweeps were collected for the second averaged response (middle trace). However, you can see that these waveforms, now having equal residual noise, replicate very well (third set of traces) making it easier to mark the waves and increasing the clinician's confidence in the response.

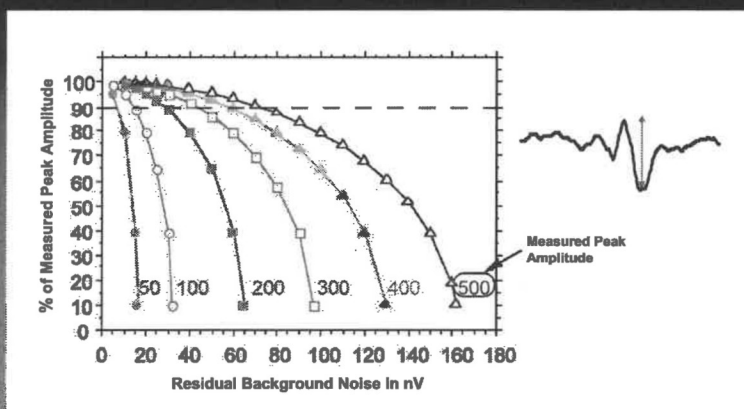


The residual Noise Level Stop Criterion uses a measure of the residual noise in the recording to terminate averaging. The lower you set the criterion value, the less noise will remain in the average and you will achieve better reproducibility of the waveforms. However, the lower the noise criterion is set, the more likely it is that you will need to average longer to achieve the noise level, which could increase your test time. Note that sometimes stopping on a residual noise criterion value will terminate averaging earlier than would have occurred if you always collected a fixed number of sweeps. So that stopping on a noise criterion does not always increase test time. Stopping the averaging based on a residual noise stopping criterion value increases the likelihood that the recorded response is mostly reflective of true neural activity.

For a standard Auditory Brainstem Response (ABR) test performed at a high intensity, such as during a neuro-otologic test, a Residual Noise Stopping Criterion set to 40 nV will probably be adequate. However, ABR tests performed down to low intensities in order to assess threshold may require a lower residual Noise Level Stop Criterion in order to optimize the chances of achieving a replicable response at low intensities when the response amplitude is small.

In the graph below, the residual noise is plotted on the x-axis, and the percent of the measured peak amplitude that is true neural response is plotted on the y-axis (slide courtesy of Dr. Manual Don, House Ear Institute and from Don and Elberling, 1996). If you measure the peak to trough amplitude of the response and find it to be 500 nV and want to be confident that 90% of that 500 nV measured peak amplitude is neural activity and not noise you can accept 75-80 nV of residual noise. Unfortunately, the amplitude of ABR responses are often approximately 200 nV. If you want 90% of the measured peak amplitude to be neural activity and not noise, you can only accept 40 nV of residual noise. Note that if there's more residual noise in that 200 nV response, like 60 nV of residual background noise, only 10% of that response is neural! Your response is not reliable!

Residual Noise Level and Neural Response



HOUSE EAR INSTITUTE

Fsp Calculation

Fsp is a statistical calculation of signal to noise in a recording. It is a measure of the variance across the entire response divided by the variance of a single point from sweep to sweep. The Fsp calculation reflects the degree of confidence that a response is present. An Fsp value of 3.1 equates to a confidence level of 99% that a response other than noise is present in the recording. Be aware that even when the Fsp is high, a qualified clinician should review the waveform to verify that the "response" that is present in the waveform is the response of interest rather than some other large signal. For example, a large post-auricular muscle (PAM) artifact can cause the Fsp to be high when the actual response of interest, the ABR for example, is absent. Likewise, a large cyclical noise present in the environment due to some electrical artifact that is synchronized with the data collection can appear in a recording and cause the Fsp to be high.

The epoch (start and stop time) for Fsp should be set within the boundaries of the amplifier epoch (window size) and in general around the part of the response that is of most interest. So that if your epoch on the amplifier tab is 16 ms (for example) and you decide that you want to set the epoch around the area where you expect waves III and V to be present, then you should set the Fsp start and stop time based on the latency where you anticipate these waves to occur. In order to optimize the setting of the Fsp start and stop times, you must consider the response of interest, the epoch, the latency of the expected response based on the delivered stimulus intensity, the age of the patient and any other factors that can influence the latency of the waves. However, the length of the Fsp epoch or analysis window (i.e., the time between the Fsp start and stop times) is determined by the high-pass cutoff frequency of the recording filters. In general, the length of the Fsp epoch must be equal to or greater than the period of the high-pass cutoff frequency of the recording filters (see Elberling and Don, 1984 for details). For the SABR protocols, because we use 100 Hz as the high-pass cutoff frequency, an Fsp epoch or analysis window of 10 ms is used. Additionally, you must set the Fsp stop time at least 0.5 ms shorter than the epoch end time.

References:

Don M, Elberling C, Waring M. Objective detection of averaged auditory brainstem responses. *Scand. Audiol.* 1984; 13: 219-228.

Don M, Elberling C. Use of quantitative measures of auditory brain-stem response peak amplitude and residual noise in the decision to stop averaging. *J. Acoust. Soc. Am.* 1996; 99: 491-499.

Elberling C. Techniques for auditory brainstem response quality estimation, detection and averaging. In: Morocutti C, Rizzo PA, eds. *Evoked Potentials. Neurophysiological and Clinical Aspects*, 1st Ed. Amsterdam, New York, Oxford: Elsevier Science Publishers B.V., 1985. page 147, figure 2)

Elberling C, Don M. Quality estimation of averaged auditory brainstem responses. *Scand. Audiol.* 1984; 13: 187-197.

Elberling C, Wahlgreen O. Estimation of auditory brain stem response, ABR, by means of bayesian inference. *Scand. Audiol.* 1985; 14: 89-96.

Stimulus tab



Click this icon on the Collection screen OR ...

Collection Protocol Setup

Protocol Name: BMAP: BioMAP Default

Add New Make Default ... Click on the Stimulus tab

Recording Stimulus Amplifier Labels/Calculations

Transducer: Insert Earphones Insert Delay (ms): 0.00

Ear: Right Stim Rate (per sec): 10.90

Polarity: Alternating Trigger In

Intensity: 80 dB SPL Intensity Step: 5

☐ Continuous Stimulus ☐ Trigger Out Pulse

Stimulus Type Dependent Values

Stimulus Type: Custom Ipsilateral Masking Parameters

Masking Type: Quiet (None)

WAV File: BioMAP_da.wav

Masking Parameters

Masking Type: None

Save Save As OK Cancel Apply

Component	Description	
Transducer field	This selection field contains a list of the transducers that you can use with the AEP system. Transducers include:	
	Headphones Insert EarphonesBone Oscillator	ER2 Inserts Broadband Inserts
	For AEP only.	For Stacked ABR/CHAMP only.

DETAILED TESTING PROCEDURES

Component	Description
Ear field	Determines the ear(s) to be stimulated: Left, Right, or Binaural (both).
Polarity field	Determines the stimulus polarity: Condensing, Rarefaction, or Alternating.
Intensity fields	Determines the intensity (dB level) to begin stimulating and the decibel reference (SPL, nHL, or HL). Note: For GraphMaster you must use the graphs that match the decibel reference used for collecting the data.
Continuous Stimulus	If selected, the stimulus stays on between averages of the same intensity. If the intensity is increased or decreased or other stimulus parameters are changed, the stimulus ramps down and ramps back up until it reaches the new intensity level.
Insert Delay (ms) field	Sets a correction value to apply to the latency caused by the delay from acoustic tubes on insert earphones. For all Bio-logic supplied tubes, the correction is 0.8 ms.
Stim Rate (per sec) radio button and field	Sets the number of stimuli presented per second. Note: Maximum allowable stimulus rate for use with GraphMaster graphs is 31.1 by default.
Trigger In radio button	Triggers in from an external stimulation device to begin response recording. All parameters of the stimulus are controlled by the external device and the AEP system performs only the recording functions. This is used for Electrical ABRs, for example. Note: You must purchase a Trigger Cable to use this feature. If performing EABR, you must also purchase a RF filter.
Intensity Step field	Determines the intensity increments the stimulus increases or decreases.
Trigger Out Pulse checkbox	Sends a sync pulse to activate an external stimulus device. Note: You must purchase a Trigger Cable to use this feature. AEP is triggered on the positive edge of a pulse of at least 100 usec duration and between 2.5 to 8 volt amplitude (TTL compatible).

Stimulus Type Dependent Values

Stimulus Type: Frequency (Hz):

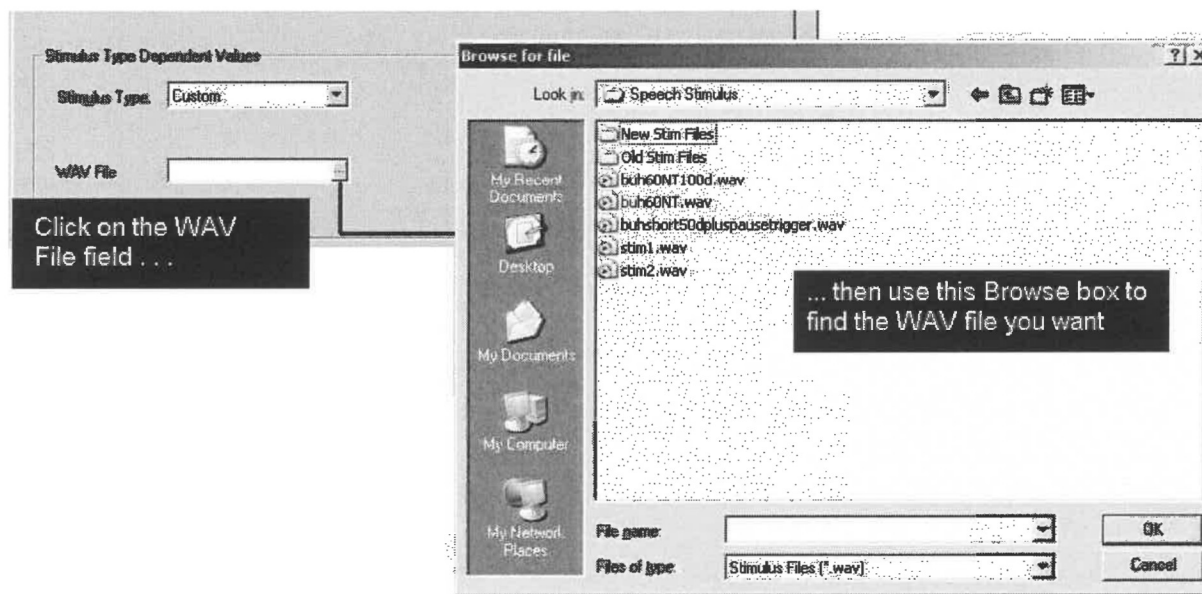
Ramp:

Plateau (cycle):

Rise/Fall (cycle):

Component	Description
Stimulus Type field	Determines the stimulus type used for the test. Options are Click, Toneburst, or Custom.
Click Duration (usec)	Determines the duration of the click. The default of 100 usec is most commonly used.
Toneburst Frequency (Hz) field	Determines the frequency of the toneburst stimulus.
Ramp field	Determines the type of Ramping used for the toneburst stimulus. Options are Linear, Hanning, Gaussian and Blackman. Displayed when Toneburst is selected.
Plateau (cycle) field	Determines the Plateau of the toneburst. Displayed when Toneburst is selected. Note: The plateau appears in cycles (not milliseconds). The default settings are based on the Gorga et al. recommendation found in: Gorga MP, Kaminski JR, Beauchaine KL & Bergman BM (1993). A Comparison of Auditory Brain Stem Response Thresholds and Latencies Elicited by Air- and Bone-Conducted Stimuli Ear Hear 14(2) 85-94. Make sure if you modify the protocol you use a value representing cycles per second (not milliseconds). Default frequency specific plateau values can be changed in User Preferences. See User Preferences section.
Rise/Fall (cycle) field	Determines the Rise/Fall of the toneburst. Displayed when Toneburst is selected. Note: The plateau appears in cycles (not milliseconds). The default settings are based on the Gorga et al recommendation found in: Gorga MP, Kaminski JR, Beauchaine KL & Bergman BM (1993). A Comparison of Auditory Brain Stem Response Thresholds and Latencies Elicited by Air- and Bone-Conducted Stimuli Ear Hear 14(2) 85-94. Make sure if you modify the protocol you use a value representing cycles per second (not milliseconds).). Default frequency specific rise/fall values can be changed in User Preferences. See User Preferences section.

Custom Stimulus



With AEP version 2.2.0 or greater, a custom stimulus can be used for the auditory stimulus output. The custom stimulus lets you use a WAV file as the stimulus presented via the selected transducer with the intensity level and rate controlled by the program. For P300 tests (optional), two different stimuli are possible: one for the frequent stimulus; one for the infrequent stimulus. To use the custom stimulus feature the protocol stimulus type must be set to "Custom" and the desired WAV file is selected.

Bio-logic does not provide wav files. The user has to provide their own wav files.

Custom Stimulus (WAV) Specifications:

File Format: WAV

Sample Rate: 48 kHz

Channels: 1 (Mono)

Bits: 16

Maximum length: 500 ms

Custom Stimulus Calibration

By default the calibration for the custom stimulus uses the transducer calibration value that is defined for the contralateral white noise for each transducer. There can be additional calibration correction values defined for each individual wav file. The additional calibration values are stored in an ASCII (text) file with the same file name as the wav file but with the extension of .nrm. The *.nrm file should contain a single integer value that can be preceded by a "+" or "-". The *.nrm file should be in the same location as the wav file and it is recommended that both files be located in the AEP program directory. If the *.nrm file is present then the value contained in the file is added to or subtracted from the value defined for the contralateral white noise for the appropriate transducer. If there is no *.nrm file then the value for the white noise is used as the calibration value.

Ipsilateral Masking Parameters

Masking Type: Quiet (None)

Masking Parameters

Masking Type: White Intensity: 80 dB SPL

Transducer: Insert Earphones ☐ **Link mask level with stim level changes**

Component	Description
Masking Type field	Ipsilateral Masking Parameters: Determines the ipsilateral masking type applied to the protocol: Quiet (None), White or Pink. This feature is currently only used for BioMAP. Masking Parameters: Determines the contralateral masking type applied to the protocol: None or White. White masking is typically used for AEP protocols and has a flat frequency response across the entire frequency range.
Transducer field	Appears when contralateral masking is selected. Defaults to the current stimulus transducer except for bone oscillator, which defaults to insert earphones.
Intensity fields	Appears when contralateral masking is selected. Sets the intensity you want to use for the masking and the decibel references: SPL, nHL, or HL.
Link mask level with stim level changes	If selected, links the masking intensity to the stimulus intensity. If you increase or decrease the stimulus by a selected increment, the masking increases or decreases by the same increment.

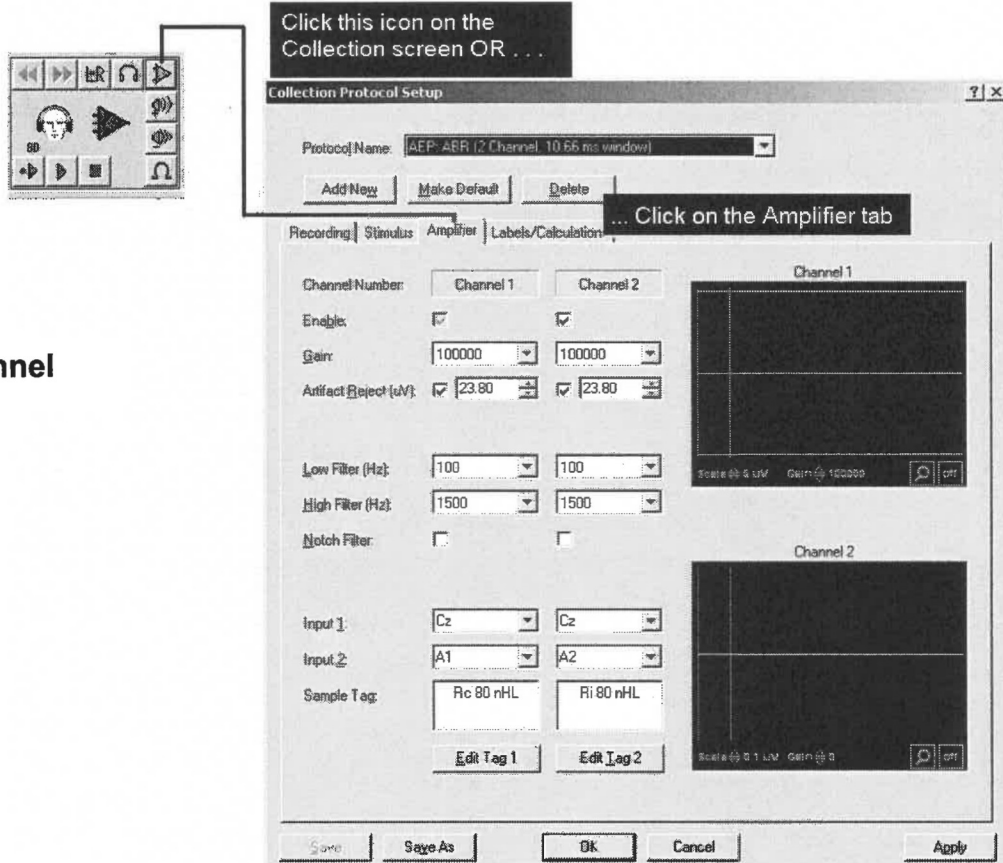
P300 Stimulus Parameters

The screenshot shows the 'Stimulus' tab of the P300 Stimulus Parameters software. The interface is organized into several sections. At the top, there are tabs for 'Recording', 'Stimulus', 'Amplifier', and 'Labels/Calculations'. The 'Stimulus' tab is selected. Below the tabs, there are various input fields and checkboxes. The 'Transducer' is set to 'Insert Earphones', 'Ear' is set to 'Right', 'Stim. Rate (per sec)' is '1.10', 'Insert Delay (ms)' is '0.80', 'Stimulus Type' is 'Tone burst', and 'Tone burst Ramp' is 'Blackman'. The 'Freq/Infreq Ratio' is '5' and 'Intensity Step' is '5'. There are checkboxes for 'Continuous Stimulus', 'Trigger Out Pulse', and 'Pseudo-random stimulation'. Below these are two sections: 'Frequent Stimulus Parameters' and 'Infrequent Stimulus Parameters'. The 'Frequent Stimulus Parameters' section has 'Polarity' set to 'Alternating' and 'Intensity' set to '70 dB HL'. The 'Infrequent Stimulus Parameters' section has 'Frequency (Hz)' set to '1000', 'Plateau (cycle)' set to '30.00', and 'Rise/Fall (cycle)' set to '10.00'. At the bottom, there is a 'Masking Parameters' section with 'Masking Type' set to 'None'.

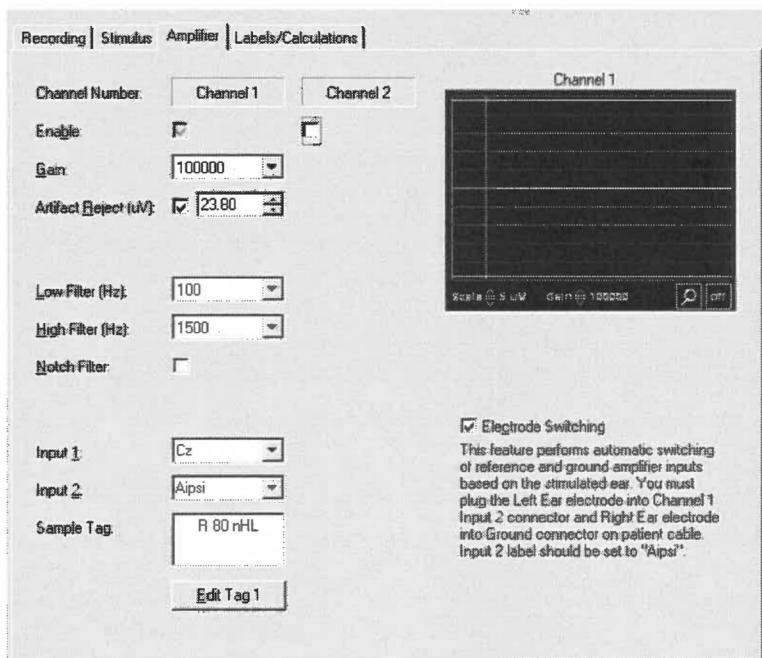
For the P300 protocol, all stimulus parameters are the same as the standard AEP stimulus parameters. P300 also includes the below additional parameters.

Component	Description
Freq/Infreq Ratio	Determines the ratio of frequent stimulus to infrequent stimulus (5 = 5 to 1 ratio)
Pseudo-random stimulation	Prevents 2 infrequent stimuli from being presented sequentially.
Frequent Stimulus Parameters	Stimulus parameters for the Frequent Stimulus. Options are determined by the stimulus type: Click, Toneburst or Custom.
Infrequent Stimulus Parameters	Stimulus parameters for the Infrequent Stimulus. Options are determined by the stimulus type: Click, Toneburst or Custom.

Amplifier tab



1 - Channel

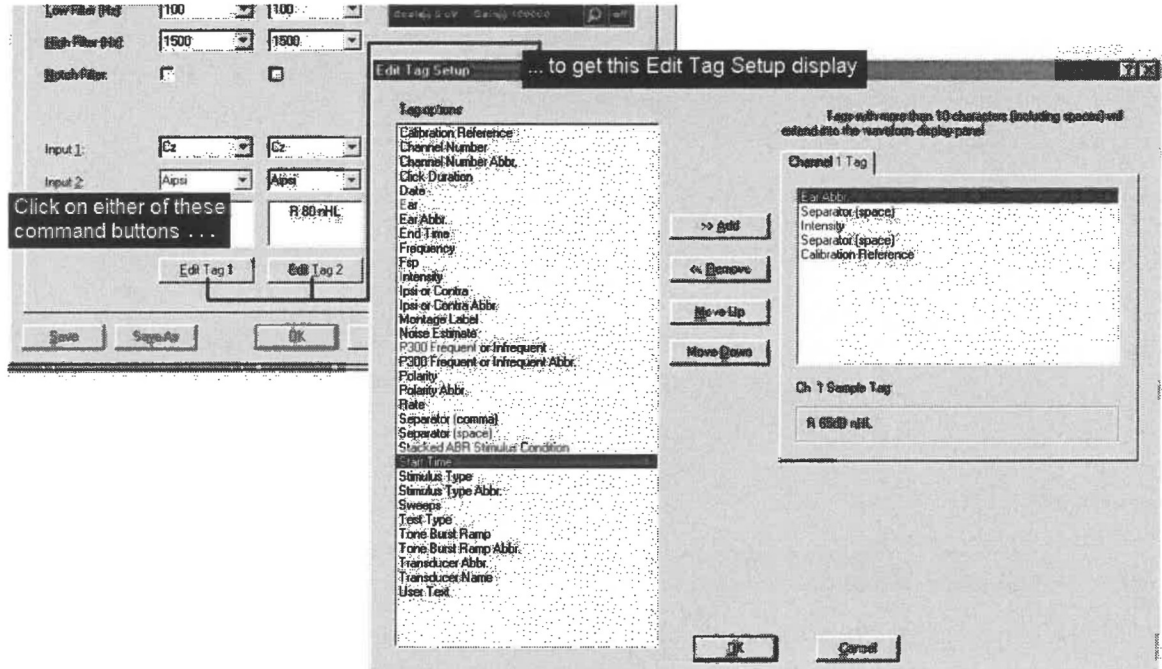


Component	Description
Channel Enable checkboxes	Select the checkbox under the Channel 2 item to activate the second channel. If you purchased a single-channel system, the second channel is not available. Note: If Channel 2 is enabled, make sure that Input 2 for both Channel 1 & 2 are set according to how you plan to plug the electrodes into the patient cable. This is important for automatic loading of collecting waves. Use A1 (left ear) for Channel 1 Input 2 and A2 (right ear) for Channel 2 Input 2 if you use the standard 10-20 system of electrode placement.
Gain fields	Determines the amplifier gain. More gain is needed for smaller responses and less gain is needed for larger responses. Reducing the gain will not reduce the just the artifact. It will reduce the neural response as well. See description of the Channel Display under the Collecting Data section of this document.
Artifact Reject checkboxes and fields	Select these checkboxes to activate artifact rejection for each channel. Each gain setting has a default artifact rejection level. To change the artifact rejection independently from the gain, type in the value desired. See description of the Channel Display under the Collecting Data section of this document. Note: If excessive environmental noise causes every sweep to be rejected, turn off the Artifact Reject (deselect checkbox) and record the noise to determine the frequency of the noise. You may need to increase the epoch to see the noise if it is 60 Hz.
Low Filter (Hz) fields	Sets the Low Cutoff Filter setting. This is a High Pass filter.
High Filter (Hz) fields	Sets the High Cutoff Filter setting. This is a Low Pass filter.
Notch Filter checkboxes	Select these checkboxes to apply the notch filter settings for each channel. The Notch Filter should only be used when troubleshooting 50 Hz or 60 Hz noise. If noise disappears when the notch filter is on, check the electrical outlet and the electrical environment (other equipment).

DETAILED TESTING PROCEDURES

Component	Description
Input 1 fields	Choose electrode placement based on the 10-20 Electrode Placement System to determine the location of Input 1. NOTE: Refer to the Electrode Connections for Bio-logic AEP System section for proper electrode placement for specific tests. Settings in these fields combined with stimulus ear setting in the Stimulus tab determine whether a channel is “Ipsilateral” or “Contralateral” for the automatic loading of collection data on the panels.
Input 2 fields	Choose electrode placement based on the 10-20 Electrode Placement System to determine the location of Input 2. NOTE: Refer to the Electrode Connections for Bio-logic AEP System section for proper electrode placement for specific tests. Settings in these fields combined with stimulus ear setting in the Stimulus tab determine whether a channel is “Ipsilateral” or “Contralateral” for the automatic loading of collection data on the panels.
Electrode Switching	For 1-Channel protocols, allows for automatic switching of reference and ground electrode based on the stimulated ear so the user does not have to manually move electrodes. Requires plugging in electrodes in a specific way. See Electrode Connections for Bio-logic AEP System section
Sample Tag fields	Displays sample tags for each Channel.
Edit Tag command buttons	Select the Edit Tag button to launch the Edit Tag setup display.

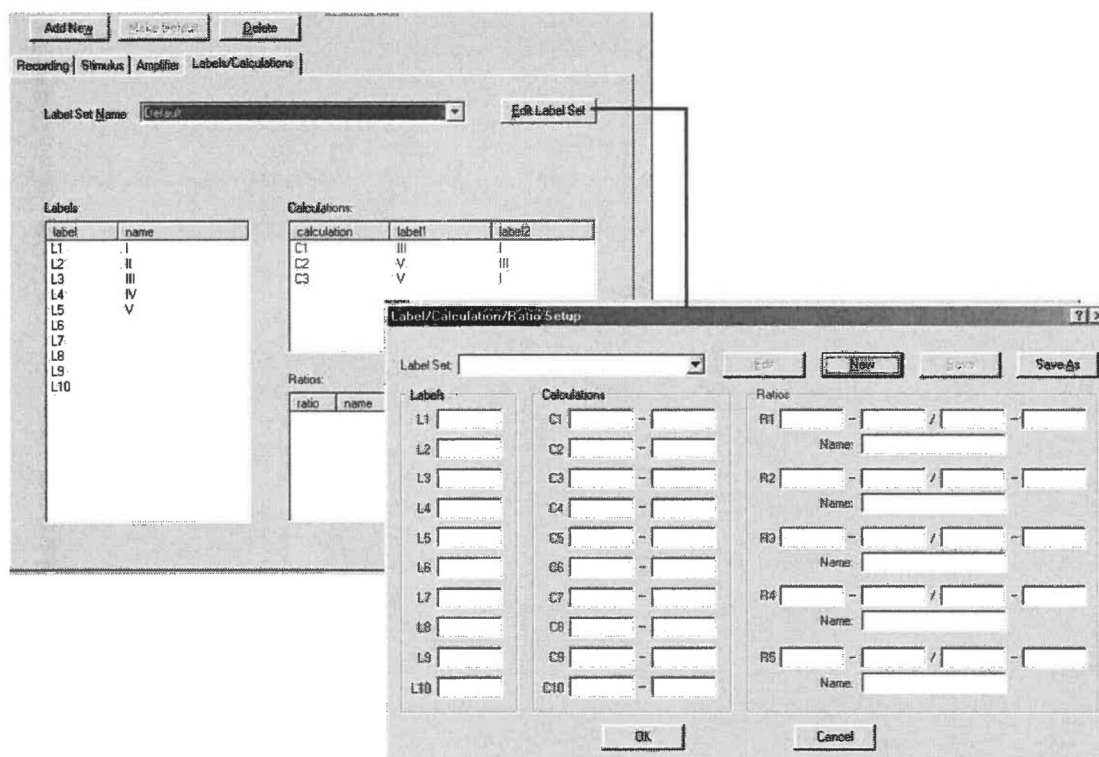
Edit Tag Setup display



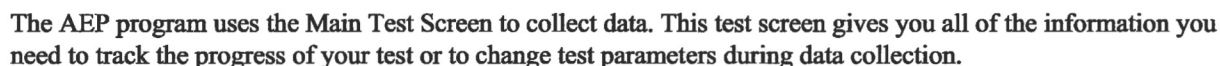
Tags will automatically display to the left side of the waveform.

Component	Description
Tag options field	Lists of optional information that you can add to either Channel Tag. User Text allows you to add a user created tag.
Add command button	Moves an item from the Tag options list to the Channel 1 or Channel 2 tag definition list.
Remove command button	Deletes highlighted item from the Channel 1 or Channel 2 tag list.
Move Up command button	Moves highlighted item(s) one position higher in the Channel 1 or Channel 2 tag list.
Move Down command button	Moves highlighted item(s) one position lower in the Channel 1 or Channel 2 tag list.
Channel 1 Tag field	Lists the information that appears in either Channel Tag.
OK command button	Closes the Edit Tag Setup display and accepts any changes.
Cancel command button	Closes the Edit Tag Setup display without making any changes.

Protocol Label/Calculation tab



Component	Description
Label Set name field	Select the arrow in this field to view a list of label sets that already exist. Choose the appropriate label set for the protocol or select the closest label set and edit it to meet your needs. Default, SABR/CHAMP and P300 label sets cannot be edited and saved with the same name.
Edit Label Set command button	Select this command button to launch the Label/Calculation/Ratio Setup dialog box and edit the selected label set to reflect your preferences.
Edit command button	Select this command button to edit the fields on the dialog box.
New command button	Creates a new Label Set under a new name.
Save command button	Saves the Label Set changes under a current name.
Save As command button	Saves the Label Set changes under a new name. The original label set remains with the original values.
Labels, Calculations, Ratios	Displays the label(s), calculation(s), and ratio(s) for the selected protocol.
OK command button	Closes the Label/Calculation/Ratio Setup dialog box and implements any changes you have saved.
Cancel command button	Closes the Label/Calculation/Ratio Setup dialog box without implementing any changes.



The splitter between Panel A and Panel B can be moved left or right to create a Split screen or a Full screen. The position of this splitter sets the latency divisions on the bottom axis of the panel.

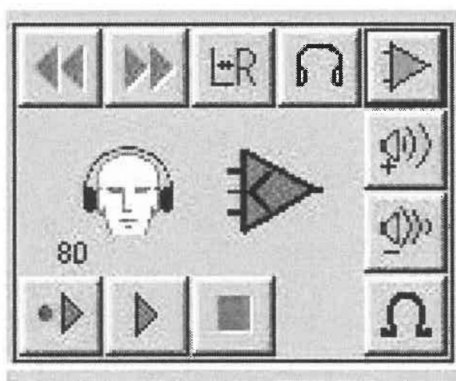
Component	Description
Channel Selection radio buttons	Select (click on) one of these radio buttons to determine the Channel(s) of data that will appear in the Display Panels when you select data from the data tree. Choices include: Channel 1 Channel 2 Ipsilateral Contralateral Both (Ipsi- and Contralateral) Remove (if remove is defaulted, you will not see any waveforms displayed on the panel, even when data is selected from the data tree). Note: During data collection the ipsilateral waveforms automatically load based on what is set in the Panel Selection in Default Display Parameters. To change the default panel loading or to automatically load contralateral or both (ipsi and contra) – see Default Display Parameters section.

Component	Description
P300 Selection radio buttons	Select (click on) one of these radio buttons to determine the P300 waveform that appears in the Display Panels. Choices include: —Infrequent: Averaged waveform derived from the Infrequent stimulus data is displayed on the panel. —Frequent: Averaged waveform derived from the Frequent stimulus data is displayed on the panel. —Both: Averaged waveform derived from both Infrequent and Frequent stimulus data is displayed on the panel. Note: Channel Selection also determines what is displayed.
Data Tree	Displays the data collected in expanding “levels” or “branches”. Select (click on) the “+” to show another branch or right click to open a level of data. Data trees are available for both Panels A & B. See Understanding the Collection Field Tree & Panels section.
Display Panels (A and B)	These panels show the waveforms. A selected panel will have a grey bar at the top of the panel and the A or B at the bottom of the field tree will be depressed to indicate which panel is active. Note: During data collection the waveforms automatically load based on the Panel Selection setting in the Default Display Parameters. See Default Display Parameters section.

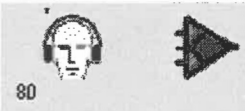
COLLECTING DATA

Component	Description
Data Averaging	The data averaging information area allows the user to track the progress of data collection. Columns of data include:
	Ear Separated by ear (Right, Left or Both) and polarity (rare & con).
	Pol Displays the count of rarefaction and/or condensation sweeps and artifacts during collection. If collecting P300 data, this column separates sweeps and artifact into frequent and infrequent.
	Swp Displays an ongoing count of the number of sweeps averaged into the response.
	Art Displays an ongoing count of the number of artifacts that occur during data collection.
EEG View Display	Shows the ongoing EEG during collection. The left graph displays Channel 1 and the right graph displays Channel 2. Blocking Line - The red line on the left side of the Channel display is the stimulus blocking line. The average preceding the red line will be blocked. You can click on this line and drag it to a different location in the epoch to decrease or increase the amount of artifact blocking. Or, right click on EEG window and left click on increase/decrease blocking will also change the blocking. Artifact Rejection Lines - The yellow lines at the top and bottom of the Channel display are the artifact rejection lines. Epochs of data that occur in-between these two lines will be averaged into the response. Epochs of data that exceed these two lines will be rejected. To change the artifact rejection, right Click on EEG window and left click on increase/decrease artifact rejection, or click on either of the red horizontal line(s) and drag them to change artifact rejection level. Scale – Increase or decrease the EEG View scaling. Scaling is displayed in uV. Gain – Increase or decrease the amplifier gain. Gain is displayed. Zoom – Opens a larger separate EEG View window for easier viewing. Off/On –Turns on or off the EEG Channel display.

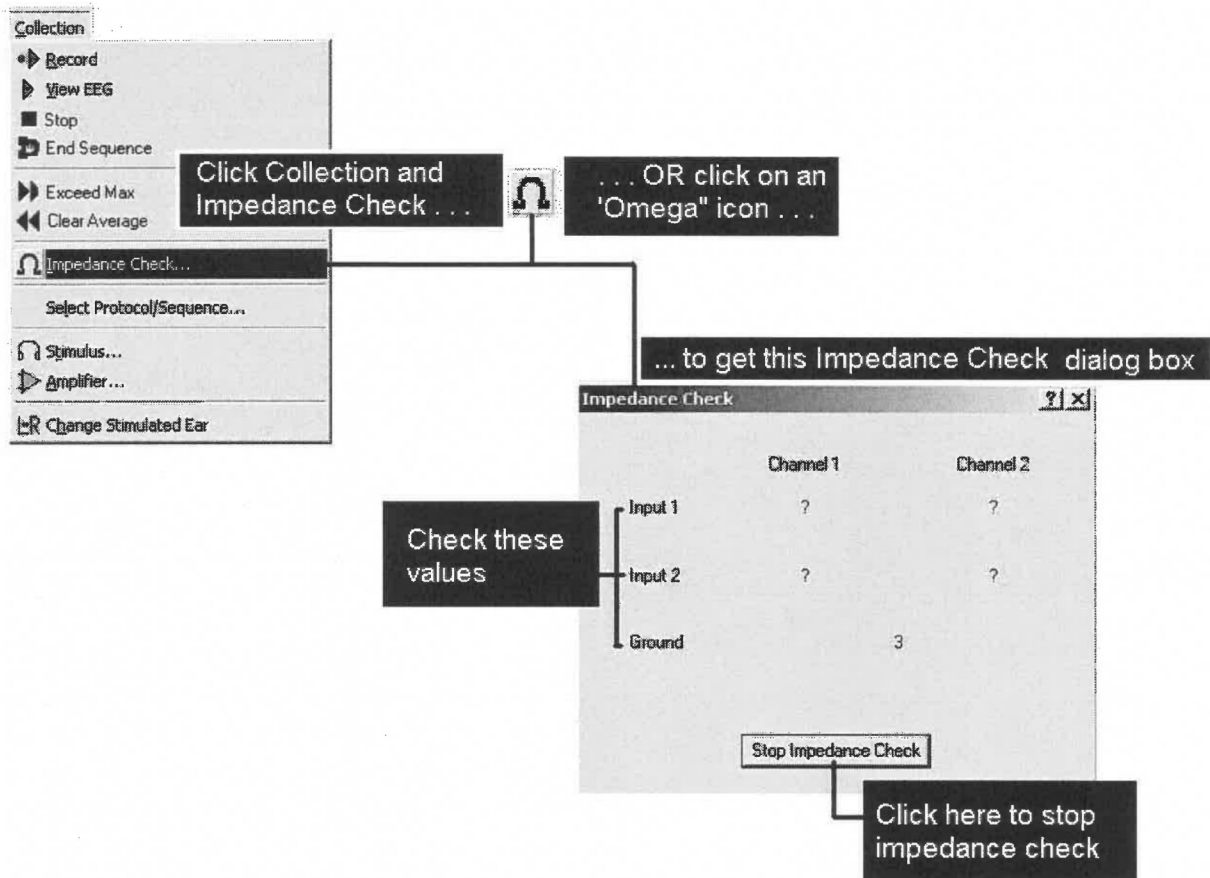
Recording Controls



Component	Description
Recording controls	The recording controls resemble standard audio-visual controls that appear on commercial recording equipment. These controls include:
	Clear Average: Resets the average. Use this to start a recording over again and discard sweeps that were collected.
	Exceed max: Exceeds the maximum number of sweeps preset in the protocol. If you select exceed maximum before the test reaches the maximum number of sweeps, the software continues averaging until you stop the test manually. You can also select exceed maximum immediately after the test reaches the maximum number of sweeps and stops automatically. Then if you choose to continue recording more averages will be added to the current waveform. You will need to stop averaging manually.
	Change stimulated ear: Changes the stimulus from one ear to the other ear. Notice the intensity dB reading will appear next to the ear being stimulated. If you use this control in the middle of collection, the data will be discarded and the test will begin again. Cannot be used with Stacked ABR/CHAMP protocols.
	Stimulus Parameters: Displays Stimulus Tab in collection protocol setup dialog.
	Amplifier Parameters: Displays Amplifier Tab in collection protocol setup dialog..
	Increase Intensity: Increases the stimulus intensity by the dB step size specified in the protocol. Using this control in the middle of collection will cause the data being collected to be discarded and the test will start over at the new intensity.
	Decrease Intensity: Decreases the stimulus intensity by the dB step size specified in the protocol. Using this control in the middle of collection will cause the data being collected to be discarded and the test will start over at the new intensity.

Component	Description	
Recording controls (continued)		Impedance test: Checks the impedance of each electrode. The impedance will only be measured in those channels selected in the protocol. That is, if a 1 Channel protocol is selected, only Channel 1 impedance will be checked.
		Stop test (recording): Stops the averaging/data collection.
		View EEG/Pause: Displays EEG in the EEG View Display. Use this to assess the patient state prior to collection. Pause lets you pause the averaging process during collection. Stimulation continues during the Pause. Use Pause with Care: You do not want to stimulate at high intensities for an extended time period.
		Record: Starts data collection.
		Stimulus Ear indicator: The intensity of the stimulus is displayed below the head and next to the ear being stimulated. The right or left headphone flashes indicating the ear being stimulated. The amplifier symbol flashes during averaging.

Impedance test



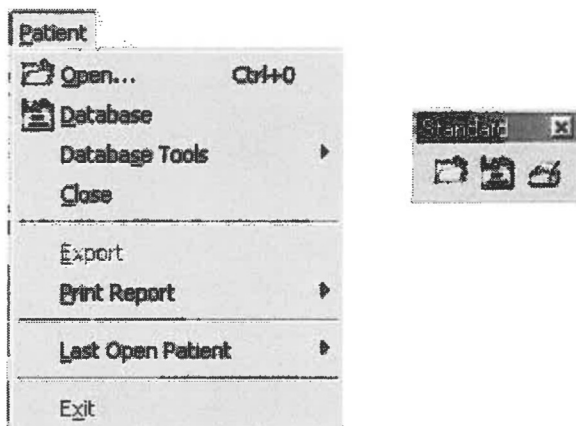
The impedance check procedure is based on the protocol selected. If a 1 Channel protocol is selected, impedance will only be checked for Channel 1. If a 2 Channel protocol is selected, impedance for both channels is checked. Low and balanced impedance values are critical to achieving high quality, low noise data. **Impedance values should be 5.0 kOhms or less and the inter-electrode difference should not exceed 2 kOhms.** Impedance values are continually being measured during the impedance test; therefore if impedance is high, press down on the electrode that is reading high or rescrub the electrode site to see if the impedance value decreases.

If a “?” is displayed the impedance is greater than 80 kOhms. Troubleshoot by making sure the patient cable and electrode leads are properly attached. A high impedance reading is not uncommon with the TM ECochGtrode.

To terminate the impedance test, select the Stop Impedance Check button. A slight delay may occur as the cycle of impedance checking is completed.

MENUS AND TOOLBARS

Patient menu and Standard toolbar



Icon and function		Description
	Open patient	Launches the Open Patient dialog box. Use this dialog box to enter new patient information or to open test(s) from existing patient information.
	Open database	Launches the Bio-logic Patient and Test Information (P&TI) database in the table view. See the Bio-logic Patient and Test Information (P&TI) database section.
Database Tools		The Database Tools menu item is part of the Patient menu. It contains three options. Each of these options launches a dialog box that you can use to backup, repair, or reduce the size of (compact) databases.
Close		Closes the patient file that is active on the AEP screen.
Export		Under Development.
	Print report	Choose to print AEP, BioMAP, or SABR/CHAMP report. Once the report type is selected the software launches a Print Preview dialog box.
Last Open Patient		Displays the name(s) and IDs of the last four patient files that were closed in the application. Select the desired Patient name or ID to reopen this patient's tests for review.
Exit		Launches a decision box that lets you close the AEP program.

Bio-logic Patient & Test Information (P&TI) database

Bio-logic Patient & Test Information - [ver. 4.0.2]

File Edit View Goto Help

Location: AEP

Patient ID	Last Name	First Name	Birthdate	Sex	Doctor	Test Date	Technician	Archive Date	Archive Disk
1	ABR -	Latency-Intensi	2/13/1970	Female	Dr. Hernand	4/2/2005 1:39:02 PM	T. Schultz		
7	VEMP		11/22/2004			11/22/2004 1:14:32 PM			
6	Stacked ABR -	PAM	10/4/2004	Female	Dr. Baker	10/4/2004 3:01:37 PM	A. Smith		
5	Stacked ABR -	Abnormal	10/4/2004	Female	Dr. Cohen	10/4/2004 1:24:25 PM	A. Smith		
4	Stacked ABR/CHAMP-	TM ECochG	8/2/2004	Male	Dr. Baker	8/10/2004 11:52:21 AM	M. Jones		
2	ABR - Tone	Burst	12/28/1947	Female	Dr. Driscoll	12/31/2003 10:36:40 AM	T. Schultz	3/1/2004	DISK 1
3	ABR -	Latency-Intensi	6/2/1998	Male	Dr. Cohen	7/30/2003 10:34:38 AM	M. Jones	3/1/2004	DISK 1
1	ABR -	Latency-Intensi	2/13/1970	Female	Dr. Hernand	5/22/2003 8:57:23 AM	T. Schultz	3/1/2004	DISK 1
*									

Ready C:\p8ti\demodata\BLPatients.mdb

The layout of the P&TI table view can be customized. The user can determine the fields included in the columns, their field labels and the order of the columns. See the Patient Setup – Table View section and Patient Setup – Field Labels section.

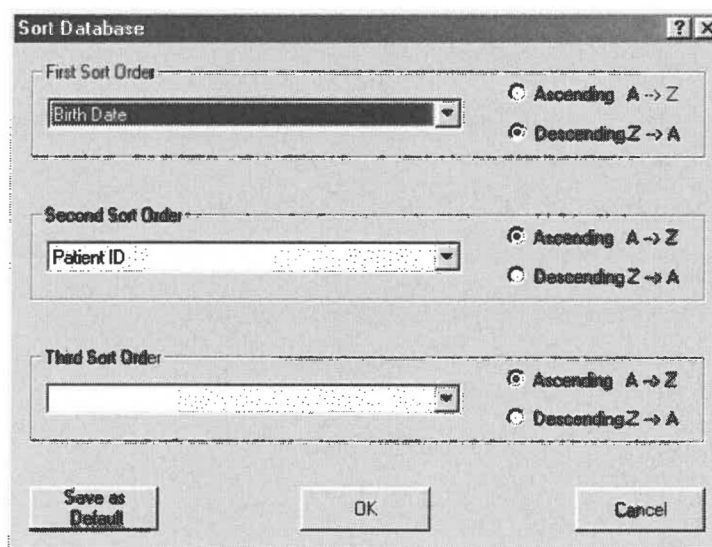
Select a patient by highlighting the patient file in the table and double click on it. This will bring the patient information into the Open Patient dialog box.

Select a patient and click on the Form View  icon. This will open the selected patient's information in the database patient info tab. See Database – Patient Info section.

Component	Description
Location	Name of the database. If there are multiple databases, this field is a drop down list. Determined by the database data path. See Data Paths Setup section.
Patient ID	IDs (e.g. medical record number) of the patients in the database.
Last Name	Last Names of the patients in the database.
First Name	First Names of the patients in the database.
Birthdate	Birthdates of the patients in the database.
Sex	Sex (gender) of the patients in the database.
Doctor	Doctors (physicians) of the patients in the database.
Test Date	Test Dates for the tests in the database.
Technician	Technicians for the test records in the database.
Archive Date	Archive Dates for the patient data in the database.
Archive Disk	Archive Disk where the patient data was archived.

Sorting the Database

- 1) Click on the sorting  icon.
- 2) You will see the screen below –Determine which field to include in the First Sort Order (e.g. Birthdate) and select either Ascending or Descending
- 3) Determine which field to include in the Second Sort Order (e.g. Last Name) and select either Ascending or Descending.
- 4) Determine which field to include in the Third Sort Order (e.g. Doctor) and select either Ascending or Descending.
- 5) Click OK to implement.
- 6) Click Save as Default to save the database sort definitions permanently.



Sort Database [?] [X]

First Sort Order
 Birth Date [v] ☐ Ascending A → Z
 ☒ Descending Z → A

Second Sort Order
 Patient ID [v] ☒ Ascending A → Z
 ☐ Descending Z → A

Third Sort Order
 [v] ☒ Ascending A → Z
 ☐ Descending Z → A

[Save as Default] [OK] [Cancel]

Reassigning a Test to a Different Patient

If a patient is accidentally tested under another patient's name and ID, perform the following steps:

1. Add the Patient ID-T field to the Table View. See Patient Setup – Table View section.
2. Make sure correct Patient's Name and ID are in the Table View. If not, add it. See Opening a Patient file section.
3. Highlight the Patient ID for the correct patient. Verify the date and time of test to make sure you have the correct file. Click Edit and Copy.
4. In the Patient ID-T column for the wrong baby but correct test, highlight the number in the Patient ID-T field. Click Edit and Paste, to paste in correct ID. Click Enter.
5. Window appears "Warning!! You are attempting to attach the displayed test information to a different patient. Do you wish to continue with this change?" Click Yes.

Backup Protocol for Patient Data

Archiving or Backing up your patient data assures that if the computer crashes, you will always have a copy of the patient information and results. It is recommended that you archive at least weekly, but preferably daily. You can choose to either archive or backup. There is no need to perform both.

You will need a large capacity medium to copy the data (i.e. read-write CD burner, a Zip Drive, etc.). Please consult with your facility's Information Technologies Department regarding the easiest way for your facility to back up your data.

Archive – Adds selected test records to a pre-determined database "archive" location with the option of deleting test results and/or deleting tests and patient information from the current database. If you choose to delete only tests, the patient names will remain in the database and indicate the date the file was archived in the Table View.

Copy – Adds selected test records to a pre-defined "copy" database location.

Backup – creates an XML file of the entire database without deleting files from the database.

Setup data paths for Archive or Copy – See Data Paths Setup section.

- Note – this is not needed for backup.
- Click Setup.
- Click Data Paths.
- Type in a Path Name (eg Archive or Copy).
- Type in File Path (eg C:\P&TI\archive) or use the browser to locate the desired file path.
- If the path does not exist, it states, "Folder does not exist. Do you want to create?" Click OK (path is created).
- Check if it is a removable drive, such as A: or zip drive.
- Click OK.

Setup default data paths for archive, copy and backup – See Patient Setup Defaults

- Click Setup.
- Click Patients.
- Click Default.
- Next to "Default Archive Patient Location", select the path name for archive using the drop down arrow.
- Repeat the above step for "Default Copy Patient Location".
- Next to "Default Backup Location", click the Browse  button. Select the path you want your Backup file to be placed (usually C:\P&TI\Backup or C:\Program Files\Bio-logic Systems Corp\AEP\Backup).
- Click Save.

Archive Patient Data

- Archiving makes a copy of selected patient tests.
- Click Open Database 

Option 1

- In the table view, highlight test records you want to archive.
- Click File.
- Click Archive Record.
- Number of records selected is displayed.
- Choose whether you want to “Delete Tests after Archive”, this will delete the tests, but the patient’s records with their names will remain in the database or “Delete Tests and Patients after Archive”.

Option 2

- Click File.
- Click Archive Record.
- Select All, Date range, Test Type (you can use date of birth, date of test, or date of discharge – recommend using date of test).
- Click OK.
- Number of records selected is displayed.
- You can choose Delete Tests after Archive (will remove test data and leave pt name and ID) or Delete Tests and Patients after Archive (removes the entire record – This is recommended to keep an efficient database).
- Click OK.
- If you choose to keep the patients’ names in the database, each patient archived will have the date, time and archive disk label of the archive in the Table or Form view if you deleted only the tests. However, the display of this field must be setup in the Table and/or Form views.

Retrieve Archived Patient Data

- Open the P&TI table view.
- At the top right corner, select the Location (Path Name) where the desired database files reside. If data is stored on a removable drive, select other. The Open browser appears, locate the path where the database resides. Select the blpatients.mdb file and click Open.

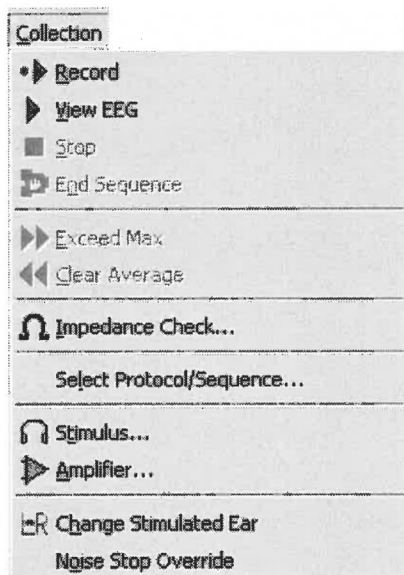
Backup Patient Data – See P&TI Database Backup Schedule Setup section

- Backup – Creates a backup of newly created or modified patient files that have not been previously backed up in XML format.
- Click Setup.
- Click Patient.
- Click Backup.
- Configure the backup – number of tests between backups & day of the month to backup.
- Click OK.

Delete a Patient Record Permanently

- Highlight test records you want to delete.
- Click File.
- Click Delete Record.
- Number of records selected is displayed.
- Choose whether you want to “Delete Tests Only”, this will delete the tests, but the patient’s information will remain in the database. Choose “Do not Prompt if File is Not Archived”, if you want the application to proceed deleting all selected records even if they have not been archived. If this is not checked you will be notified for each test record that is not archived.
- Click OK to permanently delete the selected test records.

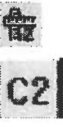
Collection menu and toolbar



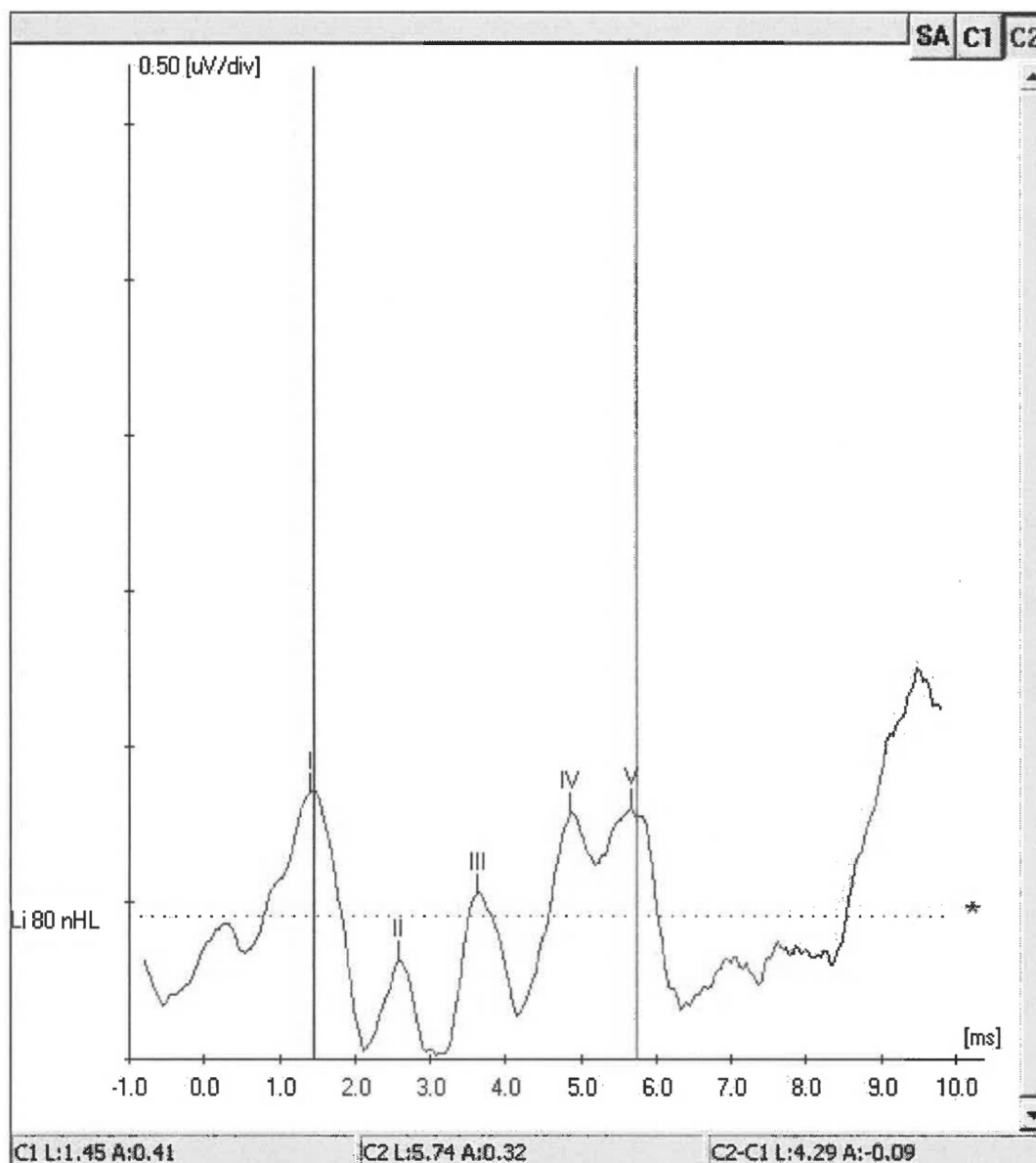
Icon and function		Description
	Record	Starts data collection.
	Pause	Pauses data collection and stimulation continues.
	Stop	Stops data collection for the protocol in effect.
	End sequence	Ends collection of an automatic sequence.
	Exceed Max	Exceeds the maximum number of sweeps in the protocol. You can select exceed maximum before the test reaches the maximum number of sweeps. The software continues averaging until you stop the test manually. You can also select exceed maximum immediately after the test reaches the maximum number of sweeps and stops automatically. Then if you begin recording more averages will be appended to the recording. You will need to stop averaging manually.
	Clear Average	Resets the average. Use this to start a recording over again and discard sweeps that were collected.
	Impedance Check	Checks the electrode impedances.
	Select Protocol/ Sequence	Lists the protocols and sequences available for data collection.
	Stimulus	Displays the Stimulus Tab of the Collection Protocol Setup screen
	Amplifier	Displays the Amplifier Tab of the Collection Protocol Setup screen
	Change stimulated ear	Switches the stimulating signal from one ear to the other. When selected during collection, the current record is discarded and a new record is begun for the other ear.
	Noise Stop Override	Sets the Noise Stopping Criteria for all protocols.

Cursors toolbar



Icon and function		Description
	Cursor 1	Makes Cursor 1 active. C1 is on the display panel.
	Cursor 2	Makes Cursor 2 active. C2 is on the display panel.
	Move left	Moves the active cursor 10 points to the left. Note: smaller increments can be achieved by using the keyboard right and left arrow keys or by clicking the mouse on the waveform.
	Move right	Moves the active cursor 10 points to the right.
	Home	Moves both of the cursors to the home location.

Using and adjusting cursors



Select Cursor 1 by using  or **C1**.

Select Cursor 2 by using  or **C2**.

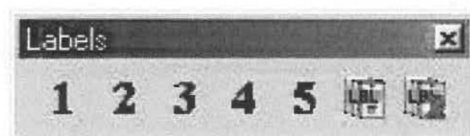
Move the cursors by:

- Clicking on  or . Moves 10 points for each click.
- Clicking on the waveform location where you want the cursor.
- Using the arrow keys on the keyboard. Moves 1 point for each key press.

The Home icon  moves the cursors to the far left or home location.

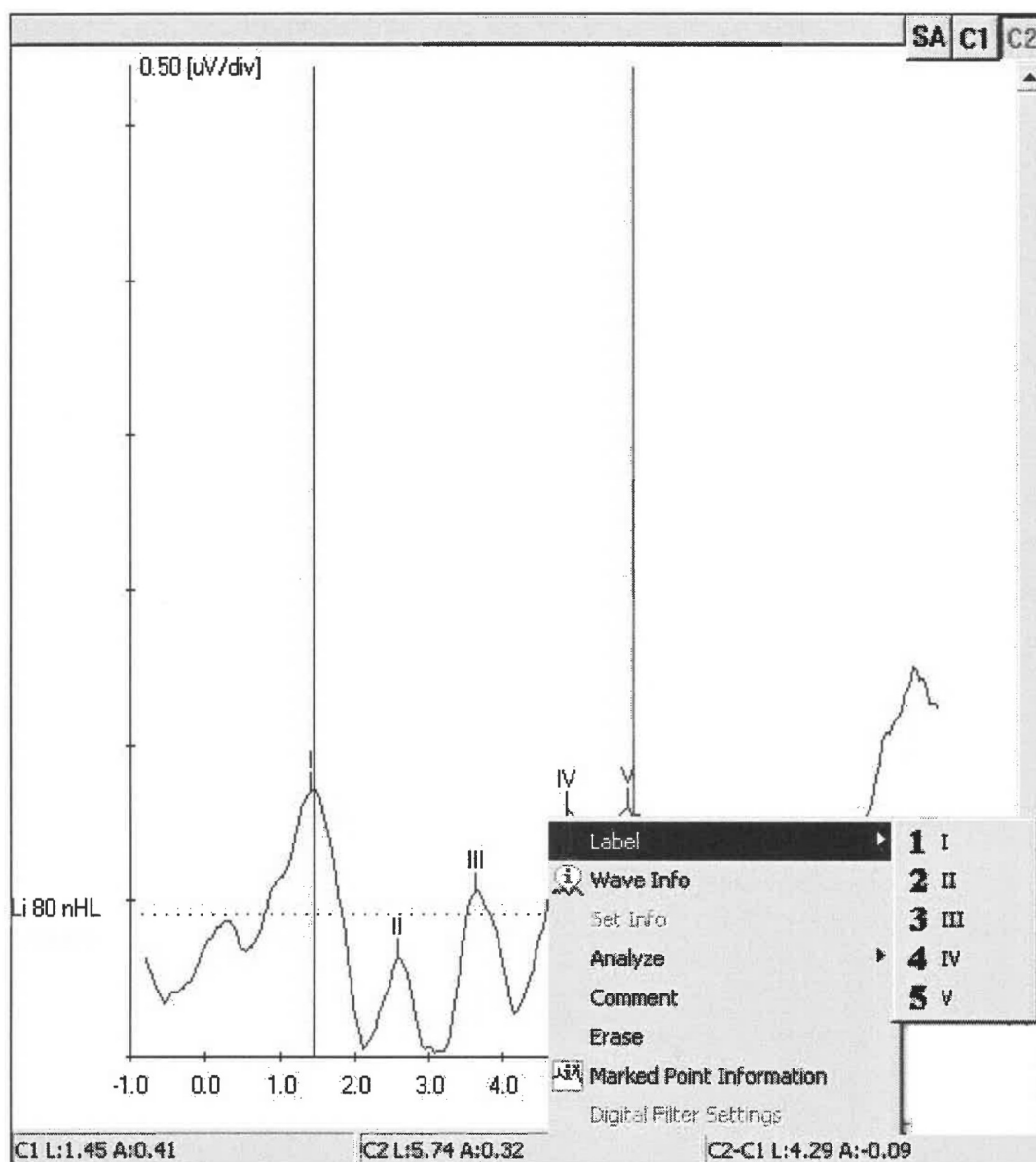
Note: A cursor status area below the waveform panel shows latency and amplitude information for each cursor location and inter-cursor measures.

Labels toolbar



Icon and function		Description
1-5	Labels 1-5 A Label Set can contain up to 10 labels.	These numbers represent the labels in the protocol. The quantity of numbers and their corresponding labels changes depending on the Labels/Calculation Set saved with the data. If you place your mouse on the number, a tool tip will display the actual label (e.g. 1 = I, 2 = II, 3 = III, 4 = IV and 5 = V)
	Modify label set	Changes the label set associated with a wave(s) highlighted on the active display panel. When a new label set is chosen for a waveform, the old labels will be erased from the wave and you will have to apply the new labels to the waveform.
	Delete label	Deletes all of the labels on the highlighted wave(s). A single label can not be deleted.

Adding Labels

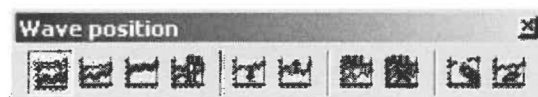
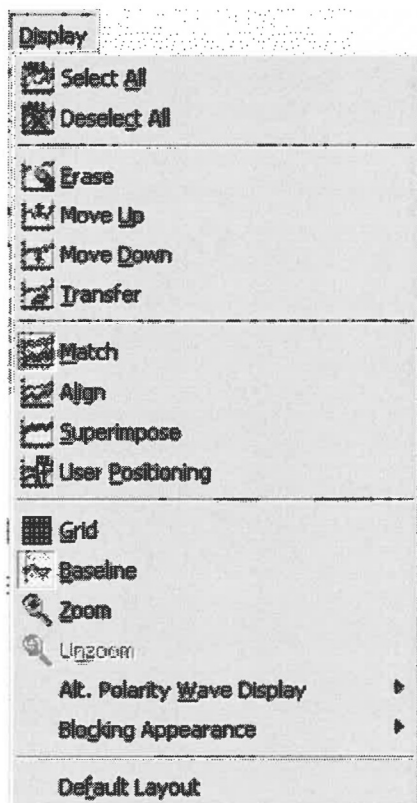


After positioning the cursor, add a label to the waveform by clicking on the corresponding label number in the toolbar, or right click on the waveform, left click on label menu item and select the desired label.

Move a label by placing the cursor to the desired location and remarking the label.

Delete all labels on the waveform by clicking on the  icon. **You cannot delete only one label at a time.**

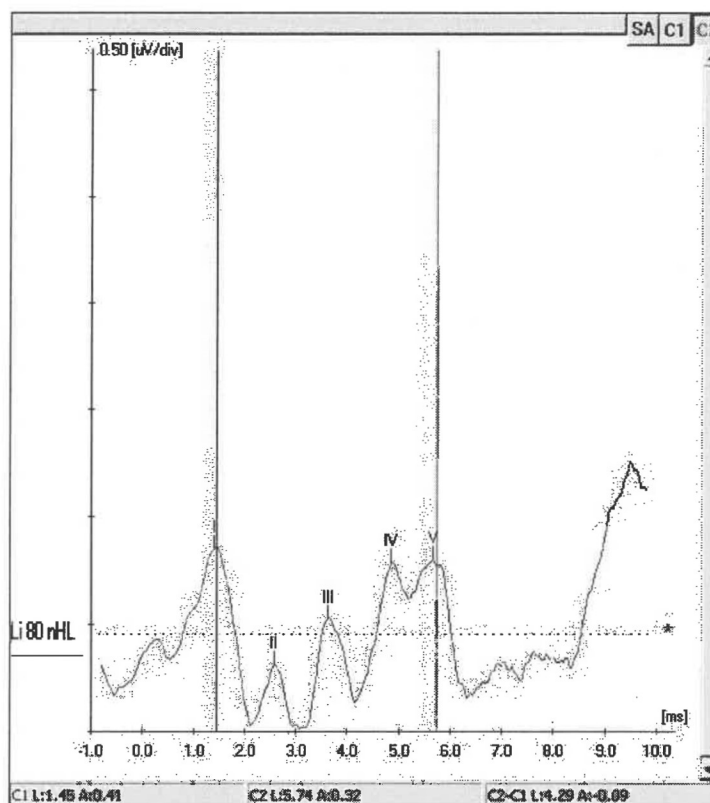
Display menu, Display toolbar, and Wave position toolbar



Icon and function		Description
	Match	Matches all displayed waveforms on the active panel according to their critical collection parameters and leaves a small space between waveform groupings.
	Align	Aligns all displayed waveforms on the active panel so their baselines are equally separated. Waveforms are still matched based on collection parameters.
	Superimpose	Matches all displayed waveforms based on critical collection parameters and superimposes their baselines.
	User positioning	Retains user positioning of waveforms. If you want the waveforms to stay where you have moved them you must have User Positioning selected.
	Move down	Moves the highlighted waveform(s) down in large increments. Selection of the down arrow key on the keyboard or clicking on and dragging the wave down on the active panel will move the wave in smaller increments.

Icon and function		Description
	Move up	Moves the highlighted waveform(s) up in large increments. Selection of the up arrow key on the keyboard or clicking on and dragging the wave up on the active panel will move the wave in smaller increments.
 	Select all	Selects all waveforms on active panel. SA button is on the display panel.
	Deselect all	Deselects all waveforms on active panel. You can also deselect waveform(s) by clicking in a blank area of the active panel.
	Erase	Erases selected waveform(s) on active panel. This only erases the waveform from the display. It does not permanently delete the waveform.
	Transfer	Transfers selected waveform(s) from the active panel to the other panel.
	Grid	Displays vertical grid lines on the active panel.
	Baseline	Displays a dotted line at the baseline of each wave on the active panel.
	Zoom	Zooms in on waveform(s) around the active cursor. Note changes in the latency scale.
	UnZoom	Restores to full view or Zooms out from waveforms on the active panel.
Alt. Polarity These functions only impact AEP waves collected with Alternating polarity.		Select (click on) this menu item and three polarity options appear: —Click the Alternating option  to show the waveform as it appears when the rarefaction and condensation sweeps are averaged together. —Click the Rare & Con option  to show the individual Rarefaction and Condensation waveforms collected using Alternating polarity stimuli. —Click the Differential option  to show the calculated difference between Rarefaction and Condensation waveforms collected using an Alternating polarity stimulus.
Blocking Appearance		 Show Flat Line – displays a flat line at the beginning of the epoch that is being blocked.  Show Response – displays the stimulus artifact/response in the portion of the epoch which is being blocked. See Recording Tab – Blocking section.
Default Layout		Sets the screen splitters controls back to the manufacturer's default settings.

Selecting and Moving the Waveform



Select the waveform by left clicking on it (this highlights the tag and puts an asterisk to the right of the waveform) or click on the corresponding record in the field tree (eg: Alt No Masking). Do not click on the tag.

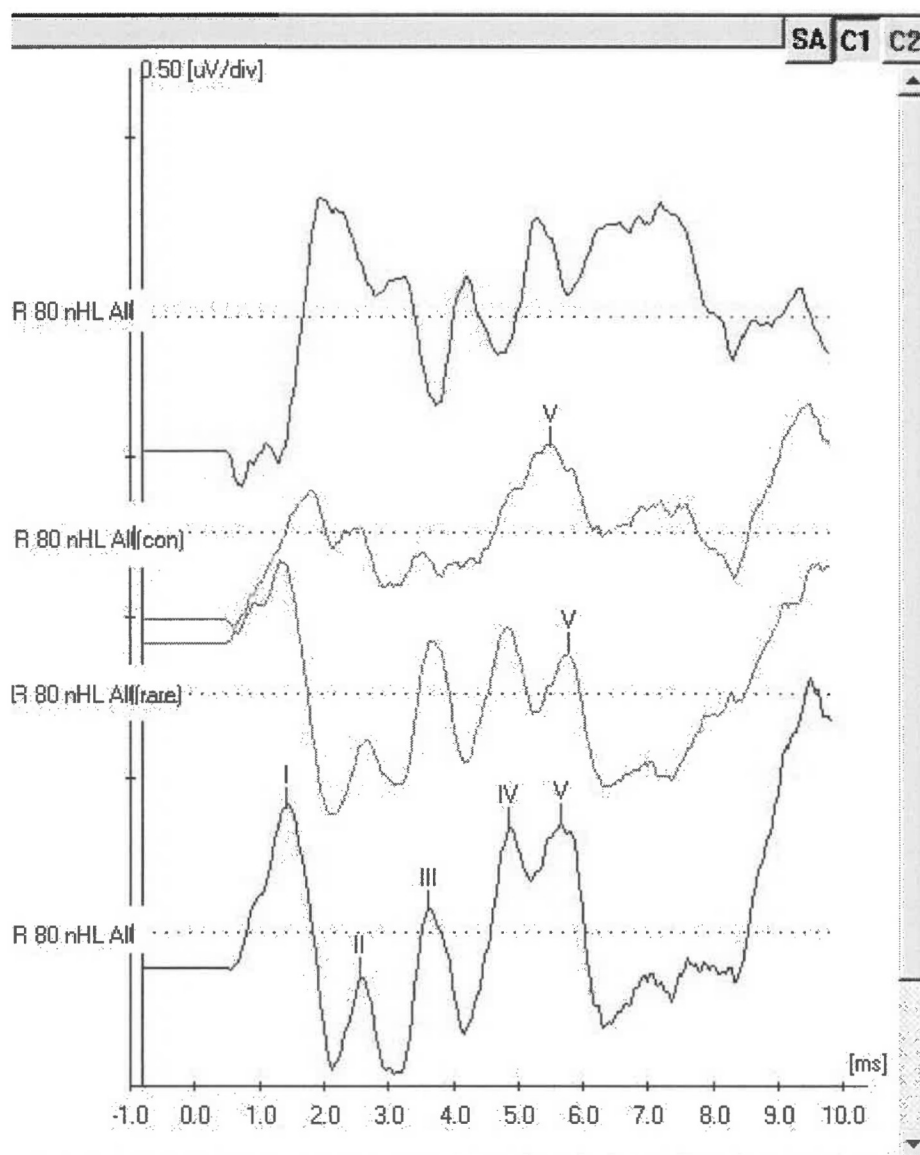
Click on  or **SA** to select all waveforms.

When a waveform is the currently collecting record, the tag in front of the wave will be highlighted in Yellow. When data collection has completed, the tag will be highlighted in Blue for the left ear, Red for the right ear, and Green for a both (bilateral) ears waveform.

Move a waveform by left clicking on it and dragging it up or down, or select the wave and use the  or  icons or use the up and down arrow keys on the keyboard.

You can select multiple waveforms by holding the Ctrl key and left clicking either on level six (polarity of stimulus & masking) of the field tree or on the waveforms in the panel.

Alt Polarity Wave Display



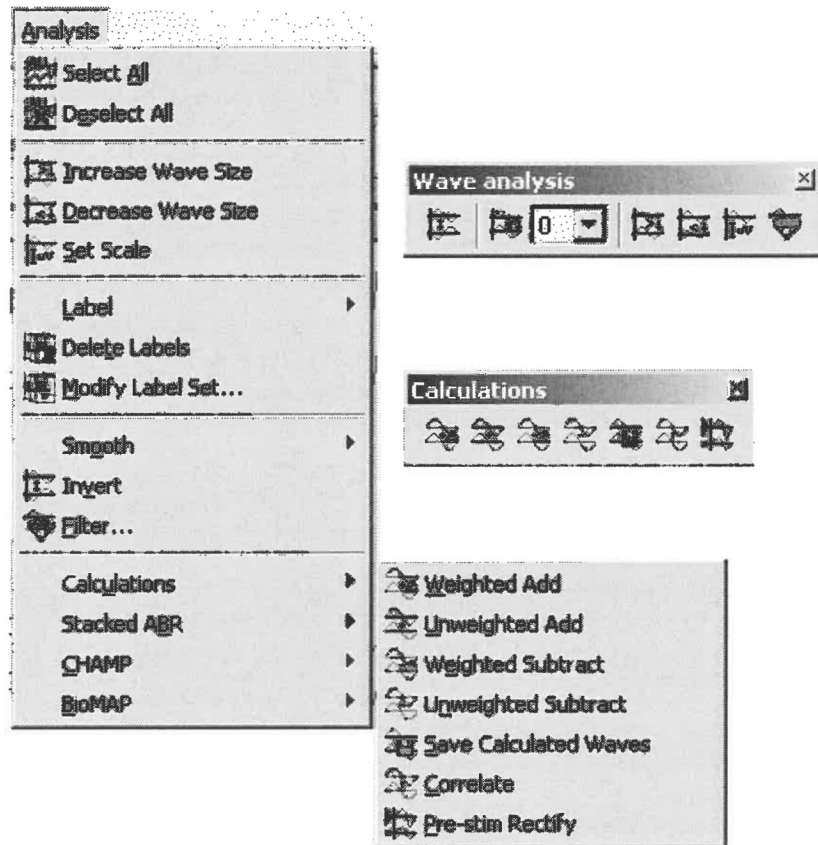
The top waveform (burgundy) is the difference between the rarefaction and condensation waveforms. The middle waveforms (grey) are the rarefaction and condensation waveforms differentiated by the (rare) and (con) label in the tag. The bottom waveform (blue for left ear or red for right ear) is the alternating waveform, the average of the rarefaction and condensation waveform.

To identify the rarefaction waveform and the condensation waveforms easily, add polarity to the tag defined in the protocol Amplifier tab. See the Edit Tag Setup section of this document.

Comparing the rarefaction and condensation waveforms is essential for determining if cochlear microphonic is present and as a diagnostic tool for identifying auditory neuropathy.

When using this feature, approximately half of the sweeps are collected in the rarefaction buffer and half of the sweeps in the condensation buffer. Increase the total number of sweeps in the protocol (see the Recording Tab section of this document) so that an adequate number of sweeps are collected in each buffer.

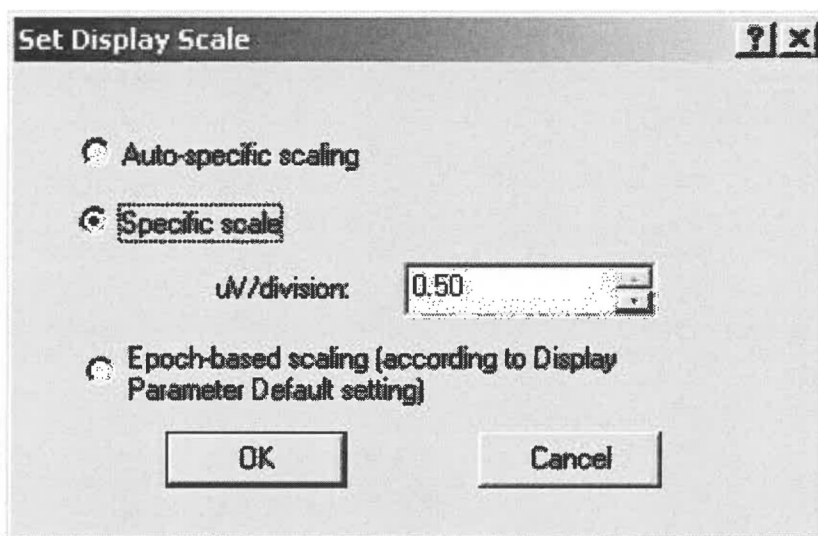
Analysis menu, Wave analysis, and Calculation toolbar



Icon and function		Description
	Select All	Selects all of the waveforms on the active panel. Any further actions you perform affect all of the waveforms selected.
	Deselect All	Deselects all of the waveforms on the active panel.
	Invert	Inverts selected waveform(s) on the active panel.
	Smooth	Smooths selected waveform(s) to the degree defined in the smooth list control.
	Smooth list	Sets the number of points to smooth (eg: 7 = 7 point smoothing). Zero (0) equals no smoothing. Then select the Smooth button to activate smoothing.
	Increase	Increases the display size of selected waveform(s) by ~ 1% each time selected.
	Decrease	Decreases the display size of selected waveform(s) by ~ 1% each time selected.
	Scale	Allows you to select the type of scaling used. If specific scale is selected, you can set the scaling in uV per division. Only selected waveforms on the active panel will be affected.

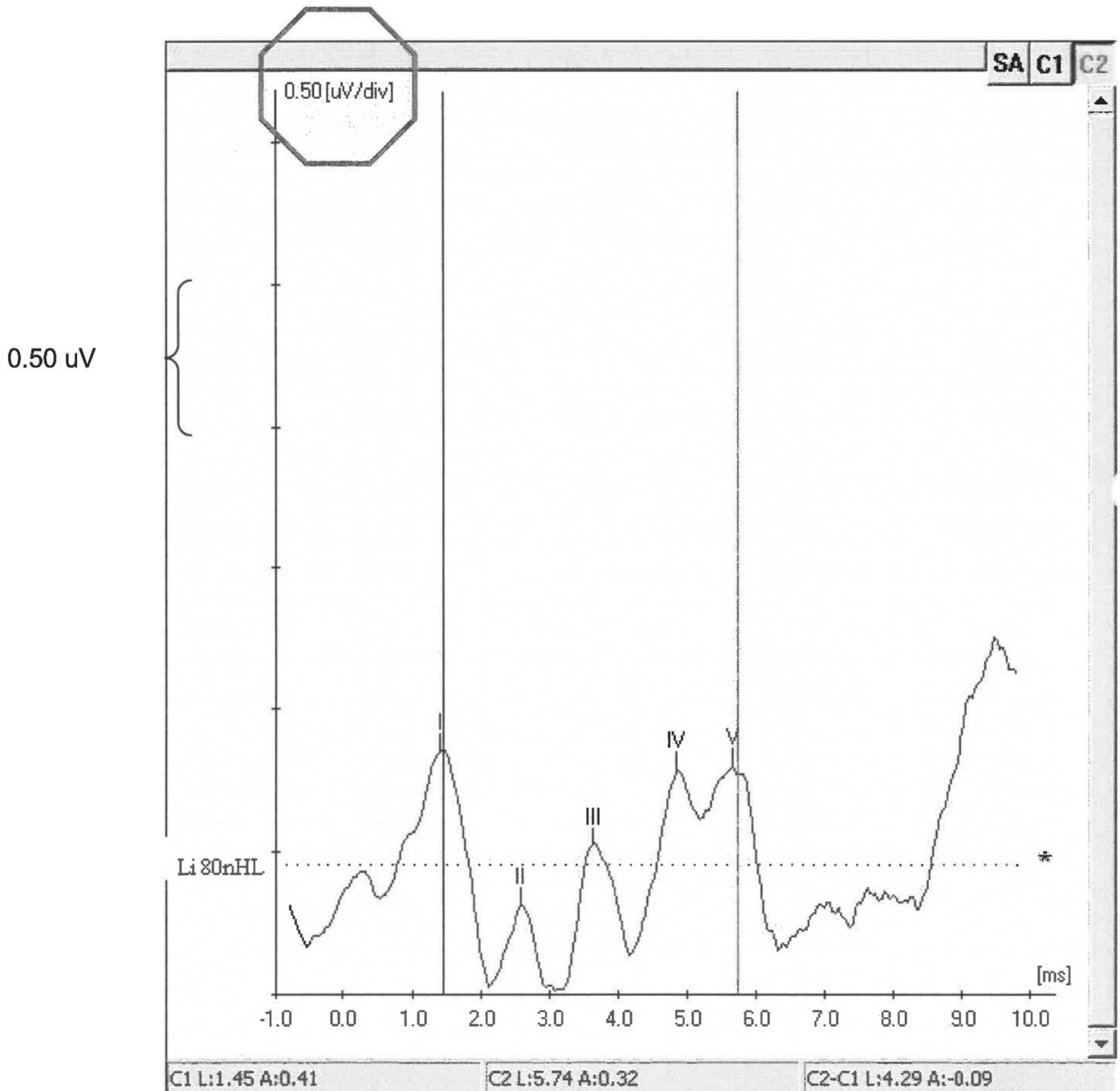
Icon and function		Description
Label		Select this menu item to get a list of labels that you can apply to selected waveforms on the test screen. The label will be applied at the location of the active cursor.
	Delete Labels	Deletes all of the labels on the highlighted wave(s).
	Modify Label Set	Changes label set to be used to mark waveforms on the selected waves. The original label set will be deleted from the waves.
	Digital Filter	Digitally filters the selected waveform(s) based on the filters chosen in the dialog. Waves are saved in the database based on the filters set during collection. That is, post hoc digital filtering cannot extend the filter settings wider than the filter settings used at the time of collection. Optional Feature.
Calculations	Note: To activate these icons, you must highlight more than one waveform. Select the first waveform, then hold down the control (Ctrl) key and select a 2nd waveform. This highlights 2 waveforms.	
 	Weighted Add: Averages 2 or more waveforms together. Weighting is based on the number of sweeps in each waveform.	Unweighted Add: Sums 2 or more waveforms together equally with no weighting.
 	Weighted Subtract: Subtracts the 2 nd waveform highlighted from the 1 st waveform highlighted. Weighting is based on the number of sweeps in each waveform.	Unweighted Subtract: Subtracts the 2 nd waveform highlighted from the 1 st waveform highlighted. No weighting is used.
 	Save Calculated Waves: Saves the calculated waveforms as a permanent part of the test database.	Correlate: Provides a correlation between 2 selected waveforms. Set Cursor 1 and Cursor 2 around the section of waveforms you want to correlate (eg Wave V). Highlight both waveforms. If the correlation is 0.90, then the section of the waveform in between the cursors is 90% similar.
	Pre-stim Rectify: Rectifies a VEMP by taking a 10 msec prestim recording and calculating the amount of EMG, then dividing the EMG value into the 256 points along the VEMP waveform. Note: Pre-Stim Rectify is a purchasable option. It can only be performed if the VEMP is collected with a protocol having a VEMP test type and not an AEP test type.	
Stacked ABR	See Stacked ABR Analysis section	
CHAMP	See CHAMP Analysis section	
BioMAP	See BioMAP Analysis section	

Set Display Scale

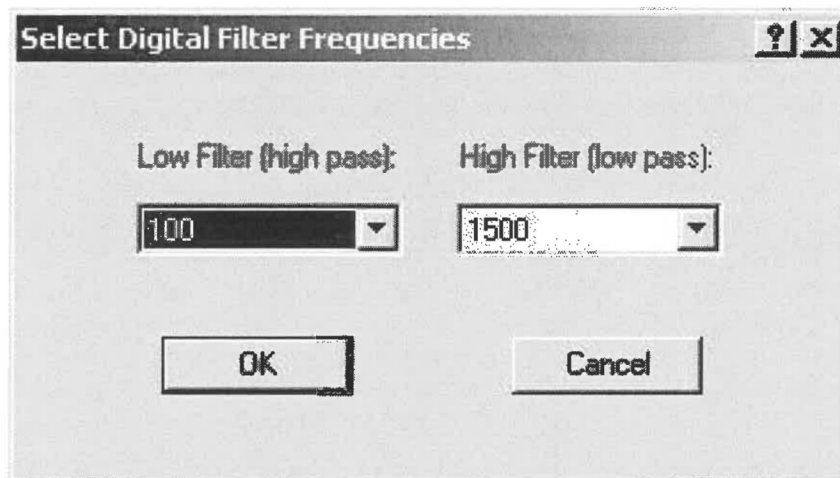


Component	Description
Scaling radio buttons	Select one of these radio buttons (bullet appears) to choose the type of scaling you want to apply. Choices include: —Auto Specific Scaling: Identifies the largest selected waveform and scales all other selected waveforms on the active panel relative to largest waveform. —Specific Scale (uV): Scales all selected waveforms to a defined scale. —Epoch-Based Scaling: Sets a specific scale based on the epoch (window) size. Epoch based scaling defaults are setup in the Default Display Parameters – see the Default Display Parameters section.
OK command button	Closes the dialog box and implement any changes that you have made to selected waves.
Cancel command button	Closes the dialog box without making any changes.

Note: If all the waveforms on the panel are scaled the same, the scaling will be displayed in the top left corner of the panel. If the waveforms are not scaled the same no value will appear.



Digital Filter



A selected waveform can be digitally filtered by narrowing the filters. If the original collection parameters set the filters narrow, you cannot digitally widen the filters. **Note: Digital Filter is an optional feature.**

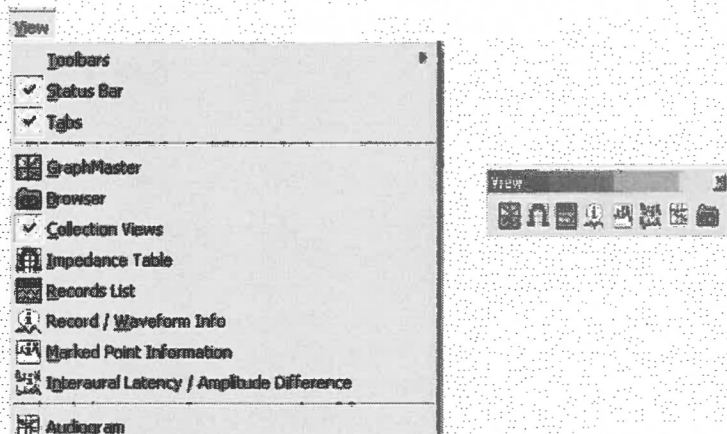
Component	Description
Low Filter (high pass) field	List of available frequencies for the Low Filter (high pass) value.
High Filter (low pass) field	List of available frequencies for the High Filter (low pass) value.
OK command button	Closes the dialog box and applies the new filters to the waveform(s) selected. This is a temporary display feature. When the wave is erased and reselected for display later, it will display with the original filter settings as collected.
Cancel command button	Closes the dialog box without making any changes to the filters.

Location toolbar



The Location toolbar lists Data Path locations where you can find AEP data. See Data Paths Setup.

View menu and toolbar



Icon and function		Description
	Toolbars	Lists Toolbars. The toolbars with a checkmark next to them will be displayed.
	Status Bar	If checked, enables the Status bar at the bottom of the screen that displays the status of the Navigator Pro hardware.
	Tabs	If checked, enables the Tabs at the bottom left corner which reflects the patient(s) for whom tests are open.
	Collection Views	If checked, the collection options (recording options around the head, the sweeps/artifacts box and EEG windows) will be displayed.
	GraphMaster	Provides Latency/Intensity graph for click stimulus utilizing Boys Town normative data, as well as other graphs. (Optional Feature)
	Impedance table	Provides a list of impedance values collected during the test session(s) if they have been saved.
	Records list	Provides a list of test records represented in the open window.
	Record/Wave info	Shows the collection parameters for the highlighted waveform.
	Marked point info	Provides latency and amplitude information for the marked points of the highlighted waveform.
	Interaural Latency/Amplitude difference	Provides interaural latency and amplitude difference information for the marked points of highlighted waveforms. You must select two waves collected with identical parameters except for the stimulus ear.
	Audiogram	Enter the audiogram for the patient. Only the last audiogram entered will be saved. The software does not store multiple audiograms. Note: The most recent audiogram must be entered for Stacked ABR in order to calculate the interaural difference.
	Browser	Allows you to browse through protocol(s), sequences, and labels/calculations sets and to print them.

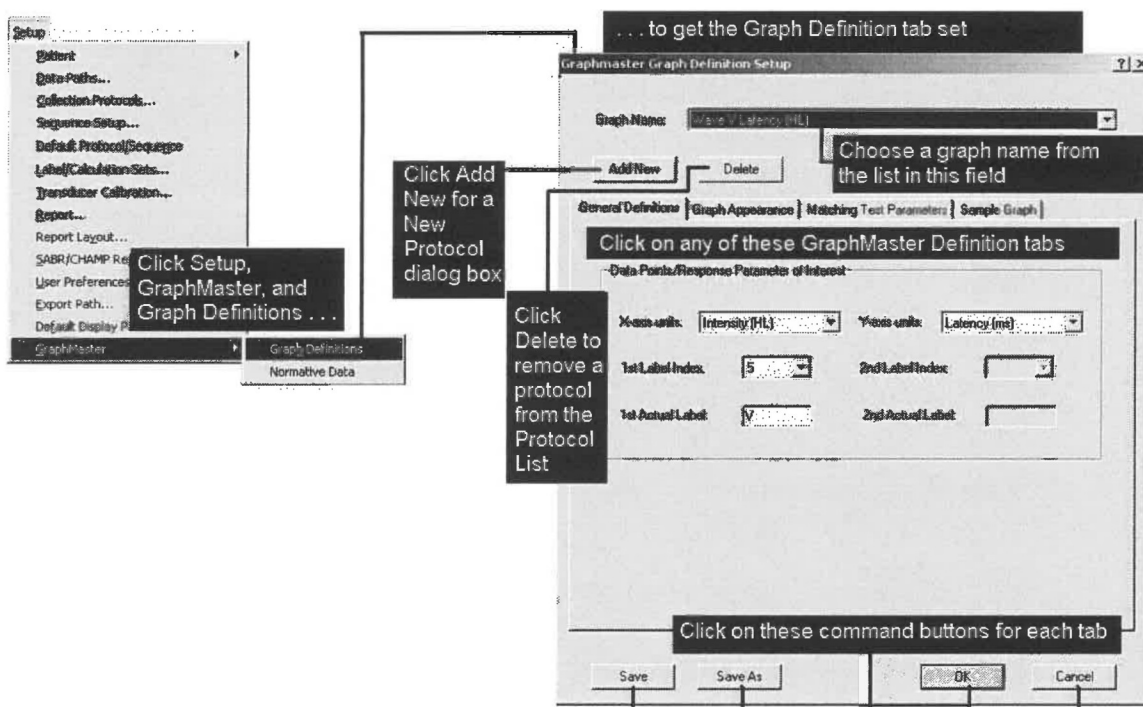
GraphMaster

The screenshot shows the GraphMaster software interface. On the left, the 'View' menu is open, showing options like 'Toolbars', 'Status Bar', 'Tags', 'GraphMaster', 'Browser', 'Collection Views', 'Impedance Table', 'Records List', 'Record / Waveform Info', 'Marked Point Information', 'Interaural Latency / Amplitude Differences', and 'Audiogram'. A callout points to the 'GraphMaster' option in the menu, stating 'Click View and GraphMaster ...'. Another callout points to a toolbar icon, stating '... OR click this icon from the toolbar ... to get the GraphMaster View screen'. The main window, titled 'GraphMaster View - 1, ABR - Latency-Intensity', displays four graphs: 'Wave I Latency (nHL)', 'Wave III Latency (nHL)', 'Wave V Latency (nHL)', and 'Wave I-V Interlatency (nHL)'. Each graph plots Latency (ms) against Intensity (dB nHL). A shaded area in each graph represents the age-specific normative range. A callout points to the dropdown arrows above the graphs, stating 'Click the down arrow next to a field above a graph display ... to see a list of graphs available'. A list of available graphs is shown, including 'Wave I Latency (nHL)', 'Wave I Latency (nHL)', 'Wave III Latency (nHL)', 'Wave III Latency (nHL)', 'Wave I-III Interlatency (nHL)', 'Wave I-III Interlatency (nHL)', 'Wave III-V Interlatency (nHL)', 'Wave III-V Interlatency (nHL)', 'Wave I-V Interlatency (nHL)', 'Wave I-V Interlatency (nHL)', 'Wave V Latency (nHL)', and 'Wave V Latency (nHL)'. A callout points to one of the graphs, stating 'Click on the graph you want to display'. The 'OK' and 'Print' buttons are at the bottom of the window.

GraphMaster is a graphic display of marked point latency data from the waves on the display panels compared to age-specific normative data. Shaded area reflects age specific normative range.

Component	Description
Graph Lists fields	Lists of the graphs available. Click on the arrow to choose from these lists.
Graph displays	As many as four different graphic displays may appear on the GraphMaster View screen.
OK command button	Closes the GraphMaster View screen.
Print command button	Starts the printing process for the graphs on the GraphMaster View screen.

GraphMaster Normative Data



GraphMaster is a powerful time saving tool for evoked potential data interpretation and is an option you can purchase from Bio-logic for your AEP system. It offers the opportunity to view and print descriptive graphs comparing marked point data to normative data boundaries. The graphs can be accessed during collection or analysis and provide pre-programmed age-specific normative latency data for click ABR. The pre-programmed infant normative data contained in GraphMaster was compiled and reported by Michael P. Gorga, Ph.D. et al.^{1,2} from Boys Town National Institute for Communication Disorders in Children. Dr. Gorga provided the adult ABR normative data through personal communication. See Reference Tables in this section.

The pre-programmed normative data includes Wave III latency values for adults only. Therefore, normative data curves will not appear on the Wave III graph when the entered age is below three years.

¹ Gorga, M. P., Reiland, J. K., Beauchaine, K. A., Worthington, D. W., Jesteadt, W. (1987) Auditory brainstem responses from graduates of an intensive care nursery: normal patterns of response. *Journal of Speech and Hearing Research*, 30, 311-318.

² Gorga, M. P., Kaminiski, J. R., Beauchaine, K. L., Jesteadt, W., Neely, S. T. (1989) Auditory brainstem responses from children three months to three years of age: normal patterns of response II. *Journal of Speech and Hearing Research*, 32, 281-288.

GraphMaster Normative Data

BOYS TOWN AUDITORY BRAINSTEM RESPONSE NORMATIVE DATA (N+1120) MEASUREMENT PARAMETERS			
Stimulus Parameters			
Type	Click		
Duration	100 msec		
Rate	13/sec		
Polarity	Rarefaction		
Intensity	20-80 dB nHL in 20-dB steps		
Transducer	Beyer DT48		
Acquisition Parameters			
Amplification	100,000		
Electrodes	Cz-to-ipsilateral mastoid with forehead ground		
Filter settings	100-3000 Hz		
Notch filter	None		
Filter slopes	6 dB/octave		
Analysis period	10.24 or 15.36 msec		
Number of sweeps	1024; two replications		
Note: Data are not reported separately for male and female subjects.			
Means (M) and standard deviations (SD) of Wave I latency at 80 dB nHL for each of six conceptual-age categories. Also included are the number of cases for each age category.			
Age group (weeks)	Number	M (ms)	SD
33-34	38	1.779	0.304
35-36	147	1.781	0.261
37-38	150	1.741	0.208
39-40	109	1.718	0.234
41-42	73	1.691	0.192
43-44	35	1.652	0.150

Means (M) and standard deviations (SD) of Wave V latencies for each of six conceptional-age categories at four levels. Also included is the number of cases for each age category.

Level (dB nHL)	Age group (weeks)	Number	M (ms)	SD
20	33-34	25	9.718	0.562
	35-36	106	9.609	0.666
	37-38	102	9.565	0.744
	39-40	83	9.355	0.567
	41-42	52	9.310	0.541
	43-44	21	9.156	0.528
40	33-34	37	8.479	0.493
	35-36	148	8.418	0.536
	37-38	157	8.290	0.510
	39-40	109	8.110	0.489
	41-42	73	8.075	0.350
	43-44	34	7.944	0.507
60	33-34	37	7.615	0.411
	35-36	148	7.576	0.429
	37-38	154	7.450	0.438
	39-40	107	7.300	0.396
	41-42	70	7.197	0.294
	43-44	33	7.082	0.327
80	33-34	38	7.054	0.394
	35-36	150	7.019	0.375
	37-38	158	6.939	0.419
	39-40	111	6.816	0.381
	41-42	74	6.687	0.294
	43-44	35	6.532	0.317

Means (M) and standard deviations (SD) of interpeak differences at 80 dB nHL for each of six age categories. Also included is the number of cases for each age category.				
Interpeak interval	Age group (weeks)	Number	M (ms)	SD
I-III	33-34	38	2.863	0.283
	35-36	144	2.848	0.269
	37-38	146	2.803	0.307
	39-40	107	2.704	0.266
	41-42	73	2.744	0.220
	43-44	32	2.650	0.255
III-V	33-34	38	2.411	0.259
	35-36	147	2.390	0.250
	37-38	154	2.345	0.260
	39-40	109	2.379	0.246
	41-42	74	2.242	0.207
	43-44	32	2.210	0.212
I-V	33-34	38	5.274	0.356
	35-36	147	5.240	0.357
	37-38	150	5.171	0.401
	39-40	109	5.090	0.359
	41-42	73	4.996	0.296
	43-44	35	4.882	0.310

Means (M) and standard deviations (SD) of Wave I latency at 80 dB nHL for each of eleven age categories. Also included is the number of cases for each age category.

Age group (months)	Number	M (ms)	SD
3-6	78	1.594	0.171
6-9	65	1.592	0.161
9-12	91	1.592	0.177
12-15	48	1.593	0.169
15-18	72	1.578	0.145
18-21	27	1.551	0.116
21-24	28	1.572	0.169
24-27	17	1.532	0.139
27-30	17	1.588	0.194
30-33	58	1.558	0.157
33-36	25	1.557	0.152

Means (M) and standard deviations (SD) of Wave V latencies for each of eleven age categories at four levels. Also included is the number of cases for each age category.

Level (dB nHL)	Age group (months)	Number	M (ms)	SD
20	3-6	79	8.717	0.526
	6-9	68	8.591	0.612
	9-12	91	8.310	0.537
	12-15	48	8.280	0.601
	15-18	74	8.329	0.609
	18-21	28	8.219	0.624
	21-24	28	8.052	0.582
	24-27	18	8.301	0.457
	27-30	18	7.981	0.417
	30-33	58	8.115	0.528
	33-36	25	8.103	0.684
40	3-6	78	7.426	0.358
	6-9	68	7.276	0.375
	9-12	88	7.049	0.366
	12-15	48	7.009	0.454
	15-18	72	6.999	0.381
	18-21	28	6.949	0.356
	21-24	28	6.794	0.334
	24-27	18	6.888	0.291
	27-30	18	6.753	0.333
	30-33	53	6.789	0.323
	33-36	24	6.815	0.378
60	3-6	62	6.734	0.331
	6-9	56	6.563	0.286
	9-12	87	6.310	0.290
	12-15	44	6.295	0.333
	15-18	62	6.242	0.245
	18-21	23	6.190	0.180
	21-24	23	6.138	0.287
	24-27	15	6.088	0.224
	27-30	13	6.082	0.283
	30-33	45	6.073	0.310
	33-36	21	6.062	0.307
80	3-6	79	6.253	0.321
	6-9	67	6.101	0.265
	9-12	91	5.899	0.268
	12-15	48	5.913	0.273
	15-18	73	5.845	0.267
	18-21	28	5.736	0.194
	21-24	28	5.712	0.262
	24-27	18	5.711	0.187
	27-30	17	5.602	0.223
	30-33	58	5.675	0.267
	33-36	25	5.678	0.273

Means (M) and standard deviations (SD) of interpeak latency differences for each of eleven age categories. Also included is the number of cases for each age category.

Interpeak latency difference	Age group (months)	Number	M (ms)	SD
I-III	3-6	78	2.523	0.215
	6-9	65	2.416	0.225
	9-12	89	2.313	0.235
	12-15	47	2.313	0.149
	15-18	70	2.258	0.157
	18-21	27	2.259	0.238
	21-24	27	2.168	0.206
	24-27	17	2.278	0.172
	27-30	17	2.099	0.137
	30-33	58	2.210	0.157
	33-36	24	2.171	0.197
III-V	3-6	79	2.128	0.215
	6-9	67	2.082	0.215
	9-12	89	1.992	0.199
	12-15	47	2.006	0.219
	15-18	71	1.999	0.163
	18-21	28	1.992	0.189
	21-24	27	1.959	0.195
	24-27	18	1.912	0.182
	27-30	17	1.915	0.155
	30-33	58	1.904	0.180
	33-36	24	1.937	0.174
I-V	3-6	78	4.653	0.287
	6-9	65	4.502	0.270
	9-12	89	4.306	0.285
	12-15	48	4.320	0.240
	15-18	71	4.252	0.224
	18-21	27	4.182	0.227
	21-24	28	4.140	0.248
	24-27	17	4.197	0.171
	27-30	17	4.015	0.215
	30-33	58	4.117	0.226
	33-36	25	4.121	0.251

Means (M) and standard deviations (SD) of interpeak latency differences for ages three and above.

Response components	dB nHL	M (ms)	SD
I	80R	*1.54	*0.11
	80L	1.54	0.12
	70	1.65	0.29
	60	1.83	0.15
III	80R	3.67	0.12
	80L	*3.69	*0.10
	70	3.85	0.12
	60	4.09	0.12
	50	4.53	0.26
	40	5.00	0.25
V	30	5.50	0.33
	80R	5.52	0.22
	80L	*5.54	*0.19
	70	5.75	0.21
	60	6.06	0.22
	50	6.39	0.24
	40	6.93	0.24
	30	7.58	0.36
I-III	20	8.36	0.54
	10	8.92	0.60
	80R	2.13	0.14
III-V	80L	*2.14	*0.23
	70	2.12	0.15
I-V	80R	1.85	0.17
	80L	*1.86	*0.14
	70	1.91	0.14
	80R	3.98	0.19
	80L	*4.00	*0.20
	70	4.03	0.25
* These values were used for the normative data in GraphMaster.			

GraphMaster Setup

The GraphMaster item contains two options:

- The Graph Definitions option
- The Normative Data option (not currently available).

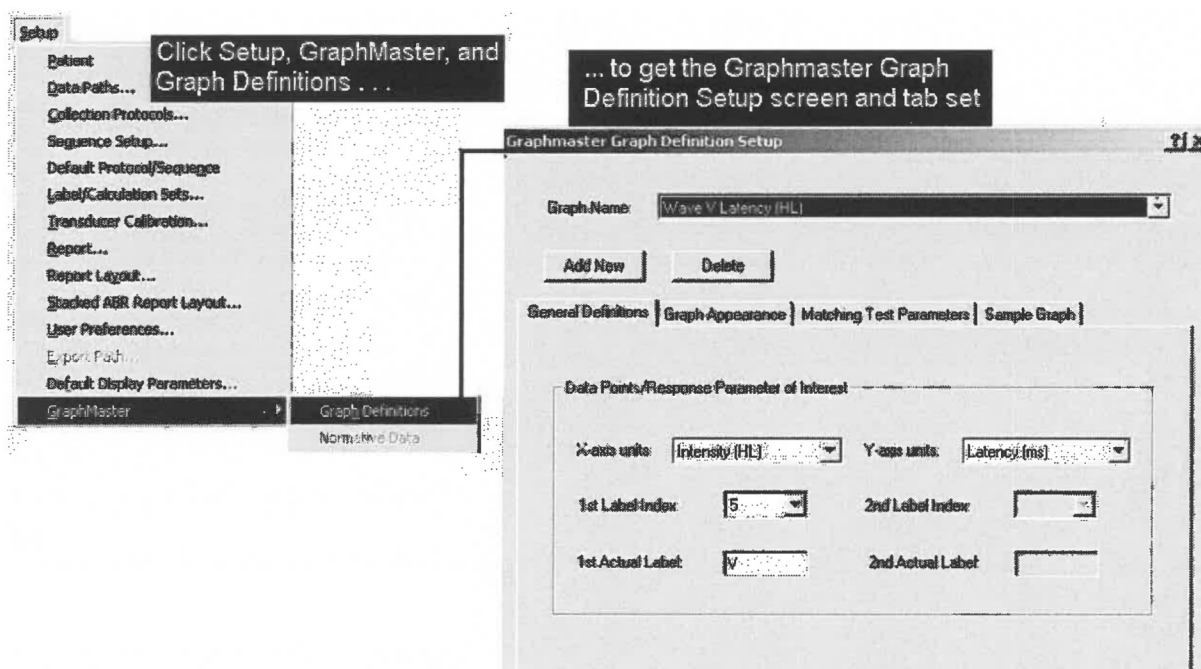
Note: The default GraphMaster Setup is optimized for use with Boys Town's normative data. Any change to the GraphMaster Setup may result in Boys Town's normative data not being valid.

Troubleshooting

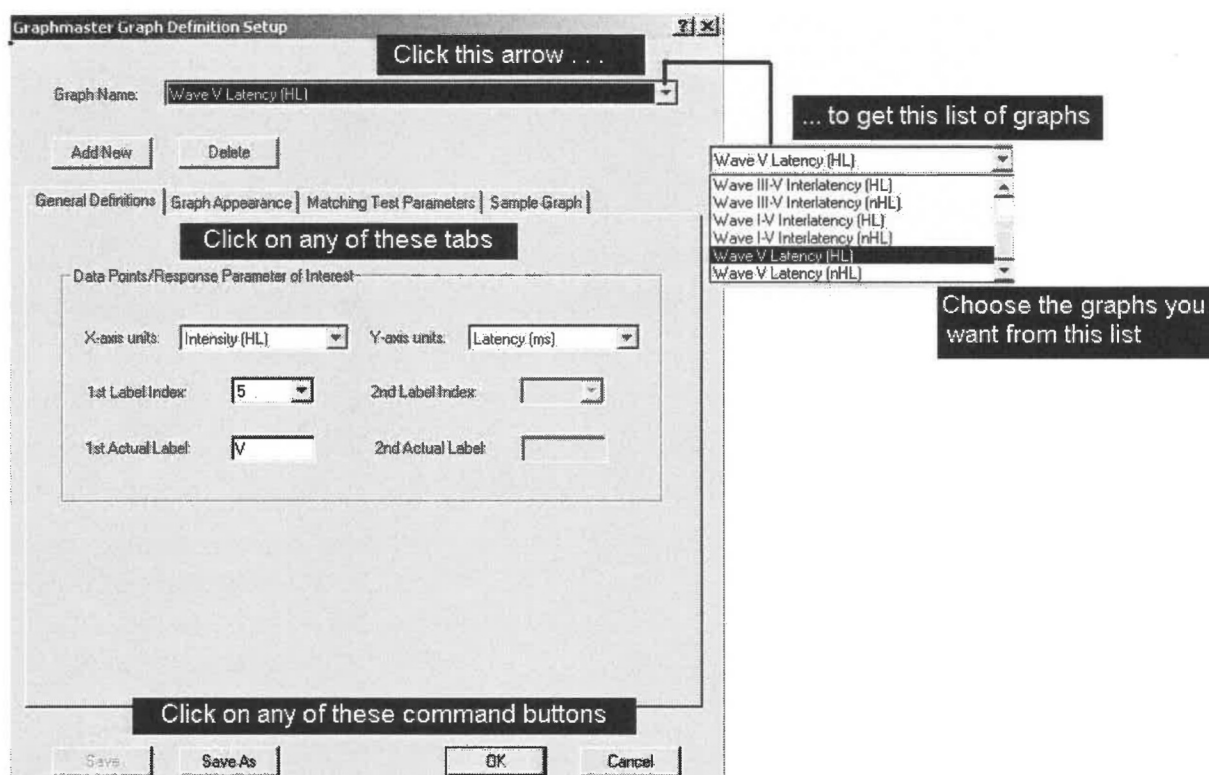
When this happens:	Check this:
Graphs present but no marked point data plotted	Do test parameters defined in the Graph definition screen match collection parameters for these data? Have the data been labeled? Are there labels that correspond to the type of graph selected?
Unexpected normative data curves accessed	Is the correct birthdate entered in the Patient Information screen?

Graph Definitions

The Graph definitions option of the GraphMaster menu item launches a set of tabs that you can use to set up the GraphMaster feature.



MENUS AND TOOLBARS



Component	Description
Graph Name field	Lists available graphs.
Add New command button	Launches a New graph dialog box and saves graph changes to a new name.
Delete command button	Removes any graph you choose from the list in the Graph Name field.
Save command button	Saves any changes to the graph selected.
Save As command button	Saves any changes to a new graph name. The program retains the original graph with its original parameters.
OK command button	Closes the Graph Setup screen and implements any changes. The program uses these changes for subsequent tests in the session. To save them permanently, you must use the Save or Save As commands.
Cancel command button	Closes the Graph Setup screen without implementing any changes.

General Definitions tab

General Definitions

Data Points/Response Parameter of Interest

X-axis units: Intensity (HL) Y-axis units: Latency (ms)

1st Label Index: 5 2nd Label Index:

1st Actual Label: V 2nd Actual Label:

Field	Description
X-axis units:	Lists the units that you can apply to the x-axis of your graph. Choices include: Intensity (db nHL); Intensity (HL); Intensity (SPL); Time (min).
Y-axis units	Lists the units that you can apply to the y-axis of your graph. Choices include: Amplitude (uV); Interamplitude (uV); Interlatency (ms); Latency (ms).
1 st Label index 1 st Actual Label	Lists the label indexes. Choices span values from 1 thru 10. The 1 st Label index (eg: L1, L2, L3, L4, L5) must match the 1 st Actual Label (I, II, III, IV, V) as determined by each protocol. Select the label index and enter the actual label you want this graph to use for plotting data. See Protocol Labels/Calculations tab section.
2 nd Label index 2 nd Actual Label	Lists the label indexes that you can apply to a trace in of your graph. Choices span values from 1 thru 10. The 2 nd Label index (eg: L1, L2, L3, L4, L5) must match the 2 nd Actual Label (I, II, III, IV, V) as determined by each protocol. See Protocol Labels/Calculations tab section.

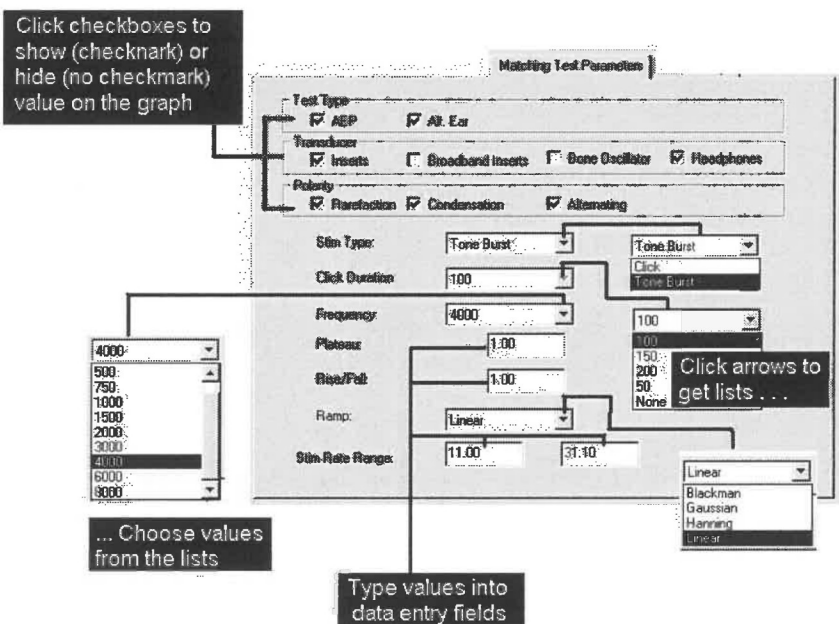
Graph Appearance tab

Graph Appearance

X axis Definitions Intensity (HL) Begin value: 0.00 End value: 120.00 Division: 10.00	Y axis Definitions Latency (ms) Begin value: 4.00 End value: 10.00 Division: 1.00
Static Standard Deviations: 2.50	Grid ☒ None ☐ Per Division ☐ Per Half Division ☐ Per 2x Division

Field	Description			
X Axis: Begin Value	Lets you enter a beginning intensity value for the X-Axis of the graph.			
X Axis: End Value	Lets you enter an ending intensity value for the X-Axis of the graph.			
X Axis: Division	Lets you set the size of the divisions for the X-Axis of the graph.			
Y Axis: Begin Value	Lets you enter a beginning value for the Y-Axis of the graph.			
Y Axis: End Value	Lets you enter an ending value for the Y-Axis of the graph.			
Y Axis: Division	Lets you set the size of the divisions for the Y-Axis of the graph.			
Standard Deviations	Lets you set standard deviation values for the graph's normative data display.			
Grid radio buttons	Lets you set grid lines for your graph. Choices are:			
	None	No grid lines appear.	Per Division	One grid line appears per division
	Per Half Division	Two grid lines appear per division	Per 2x Division	One grid line appears for each 2 divisions

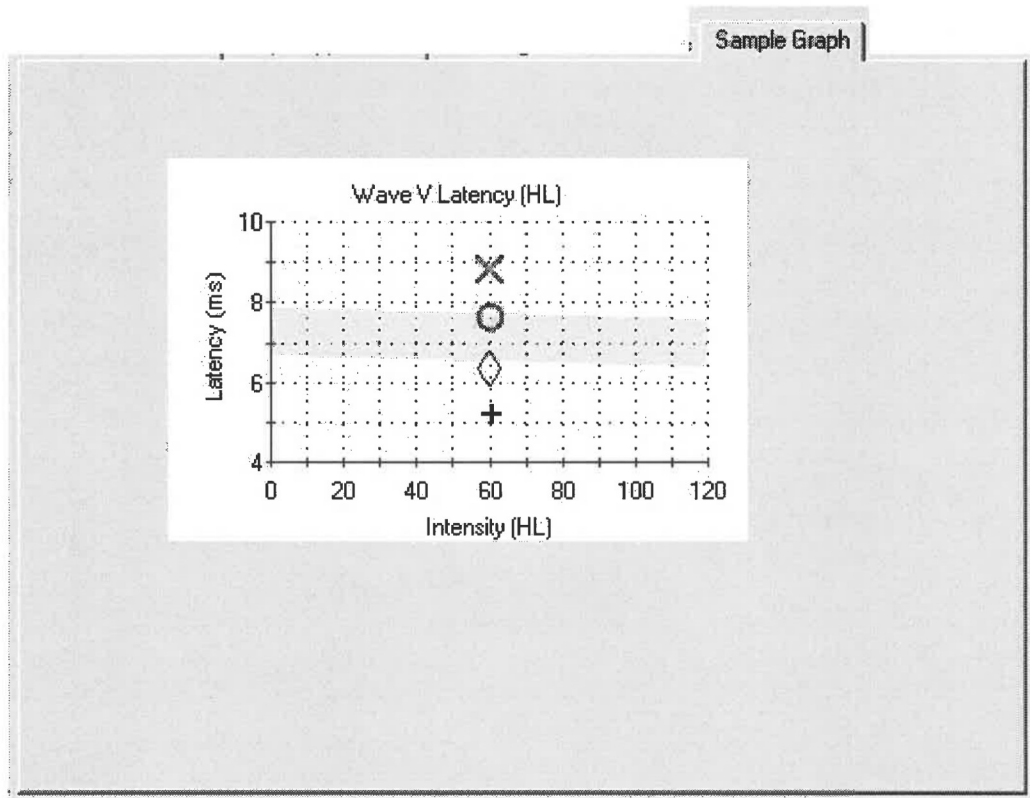
Matching Test Parameters tab



Note: The Click Duration field is active only if you choose the Click option from the Stim type field. The Frequency, Plateau, Rise/Fall and Ramp options are active only if you choose the Tone Burst option from the Stim type field.

Component	Description
Test Type Checkboxes	Determines the Test Type that is utilized for this graph. Alt Ear (Alternating Ear) is not currently implemented.
Transducer Checkboxes	Determines the Transducer that is utilized for this graph. Options are Inserts, Broadband Inserts.
Polarity Checkboxes	Determines the stimulus Polarity that is utilized for this graph. Options are Rarefaction, Condensation, and Alternating.
Stim Type selection field	Determines the Stimulus Type that is utilized for this graph. Options are Click and Tone Burst. (Boys Town normative data only applies to Click data)
Click Duration selection field	Determines the Click Duration that is utilized for this graph.
Frequency selection field	Determines the Toneburst Frequency that is utilized for this graph. This can only be used with user defined normative data (feature not currently available).
Plateau field	Determines the Toneburst Plateau that is utilized for this graph. This can only be used with user defined normative data (feature not currently available).
Rise/Fall field	Determines the Toneburst Rise/Fall that is utilized for this graph. This can only be used with user defined normative data (feature not currently available).
Ramp selection field	Determines the Toneburst Ramp that is utilized for this graph. This can only be used with user defined normative data (feature not currently available). Options are Blackman, Gaussian, Hanning, and Linear.
Stim Rate Range field	Determines the Stimulus Rate that is utilized for this graph. Default graphs allow data collected with click rates up to 31.1/sec to be plotted although the normative data was collected at a rate of 13.1/sec. It is not recommended that a rate greater than 31.1/sec be set in the graph definitions.

Sample Graph tab



The Sample Graph tab is a reference display. It allows you to visualize some of the parameters you have set in the Graph Appearance tab.

Legend:

X (blue) = left ear stimulated

O (red) = right ear stimulated

◇ (green) = binaural stimulation

⊕ = designates where the cursor is placed on the waveform

Impedance Table

Date	Time	Ch.1 Input 1	Ch.1 Input 2	Ch.2 Input 1	Ch.2 Input 2	Ground
5/22/2003	10:30:24...	1 (Cz)	1 (A1)	1 (Cz)	1 (A2)	1

OK Print All

The Impedance values checked are based on the protocol selected. If a 1 Channel protocol is selected, impedance will only be checked for 1 Channel. If 2 Channel protocol is selected, impedance for both channels is checked. Impedance values are displayed in the table. Each impedance test is marked with the date and time it was initiated. This table will show any saved impedance values for the test sessions represented on the window.

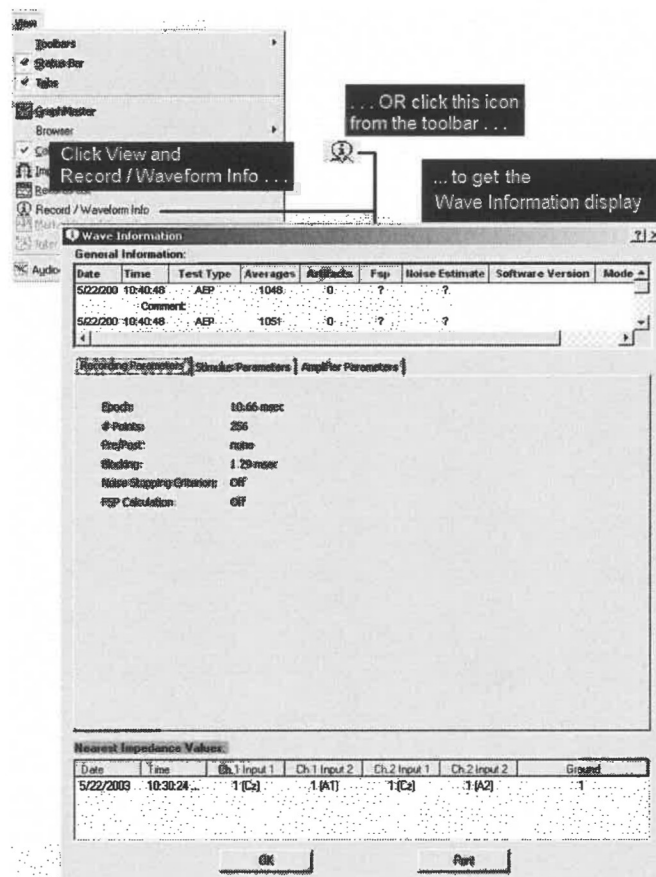
Select OK to close the dialog. Select Print All to print out the impedance table view.

Records list

Records List - 1, ABR - Latency-Intensity														
Date	Time	Test Type	Channel	Epoch	Ear	Polarity	Stim. Ty	Frequen	Intensity	Rate	Average	Artifacts	Fsp	Noise E
5/22/2003	10:00:13	AEP	2	10.66	Right	Alt.	Click	80 dB nHL	13.3	2000	0	?	?	
Comment:														
5/22/2003	10:02:58	AEP	2	10.66	Right	Alt.	Click	80 dB nHL	13.3	2000	0	?	?	
Comment:														
5/22/2003	10:05:46	AEP	2	10.66	Right	Alt.	Click	60 dB nHL	13.3	2000	0	?	?	
Comment:														
5/22/2003	10:08:30	AEP	2	10.66	Right	Alt.	Click	60 dB nHL	13.3	2000	0	?	?	
Comment:														
5/22/2003	10:11:18	AEP	2	10.66	Right	Alt.	Click	40 dB nHL	13.3	2000	0	?	?	

Component	Description																
Data columns	These columns list information about the AEP tests you have open for this patient. Each row is another AEP test record. Columns include: <table> <tr> <td>Date: Lists the date for each test record.</td><td>Time: Lists the time each test record was started.</td></tr> <tr> <td>Test type: Lists the type of test that produced each record.</td><td>Channel: Lists the number of channels collected.</td></tr> <tr> <td>Epoch: Lists the epoch (window size).</td><td>Ear: Identifies the ear stimulated.</td></tr> <tr> <td>Polarity: Lists the stimulus polarity.</td><td>Stim. Type: Lists the type of stimulus.</td></tr> <tr> <td>Frequency: Lists the toneburst frequency.</td><td>Intensity: Lists the stimulus intensity and calibration reference.</td></tr> <tr> <td>Rate: Lists the stimulus rate.</td><td>Averages: Lists the averages collected.</td></tr> <tr> <td>Artifacts: Lists the artifacts that occurred during the data collection.</td><td>Fsp: Lists the Fsp value.</td></tr> <tr> <td>Noise Estimate: Lists the residual noise estimate.</td><td>Ipsi Mask Type: Lists the type of the ipsilateral masking. (BioMAP test type only)</td></tr> </table>	Date: Lists the date for each test record.	Time: Lists the time each test record was started.	Test type: Lists the type of test that produced each record.	Channel: Lists the number of channels collected.	Epoch: Lists the epoch (window size).	Ear: Identifies the ear stimulated.	Polarity: Lists the stimulus polarity.	Stim. Type: Lists the type of stimulus.	Frequency: Lists the toneburst frequency.	Intensity: Lists the stimulus intensity and calibration reference.	Rate: Lists the stimulus rate.	Averages: Lists the averages collected.	Artifacts: Lists the artifacts that occurred during the data collection.	Fsp: Lists the Fsp value.	Noise Estimate: Lists the residual noise estimate.	Ipsi Mask Type: Lists the type of the ipsilateral masking. (BioMAP test type only)
Date: Lists the date for each test record.	Time: Lists the time each test record was started.																
Test type: Lists the type of test that produced each record.	Channel: Lists the number of channels collected.																
Epoch: Lists the epoch (window size).	Ear: Identifies the ear stimulated.																
Polarity: Lists the stimulus polarity.	Stim. Type: Lists the type of stimulus.																
Frequency: Lists the toneburst frequency.	Intensity: Lists the stimulus intensity and calibration reference.																
Rate: Lists the stimulus rate.	Averages: Lists the averages collected.																
Artifacts: Lists the artifacts that occurred during the data collection.	Fsp: Lists the Fsp value.																
Noise Estimate: Lists the residual noise estimate.	Ipsi Mask Type: Lists the type of the ipsilateral masking. (BioMAP test type only)																
Comment	Comment placed in the data tree will be displayed in the Records List. See Understanding the AEP Collection Field Tree & Panels.																
OK command button	Closes the Records list dialog box.																
Print List command button	Prints the Records list dialog box.																

Record / Waveform Info



The Record / Waveform menu item in the View menu launches either a Records Information display or a Waveform Information display. These displays list information about a particular waveform or a particular record. See Understanding the AEP Collection Field Tree and Panel section for additional ways to access Record/Wave Info.

Component	Description
General Information area	This area of the dialog contains columns that describe information about waveforms in a Record. Rows of data in this area represent the various waves associated with this record. (e.g. Channel 1 and Channel 2 for a 2 Channel recording) Columns include:
Date: Date record was collected	Time: Time wave was collected
Test Type: Test type for the record	Averages: Number of averages accepted for wave.
Artifacts: Number of artifacts rejected.	Fsp: Fsp value for the wave (if selected on Recording Parameters Tab).
Noise Estimates: Residual Noise value for the wave (if selected on Recording Parameters Tab). Note: Performing a weighted add using collected waves for which noise estimation has been calculated will recalculate the residual noise for the calculated waveform.	Software Version: Version of software being used.
Model: Displays the hardware model number.	

MENUS AND TOOLBARS

Component	Description	
Recording Parameters Tab	Lists information about the recording parameters used to collect this record.	
Stimulus Parameters Tab	Lists information about the stimulus parameters used to collect this record.	
Masking Field	Lists the Masking parameters if masking was used.	
Amplifier Parameters Tab	Lists information for the channels in this record. This information includes readings for Gain, Low Filter, High Filter, Artifact Rejection, Input 1, Input 2, and Electrode Switching status.	
Nearest Impedance Values area	Displays the results of impedance test that were performed around the time that this record was collected, if the impedance results were saved. Columns include:	
	Date	Time
	Ch 1 Input 1	Ch 1 Input 2
	Ch 2 Input 1	Ch 2 Input 2
	Ground	
OK command button	Closes this display.	
Print command button	Starts the printing process for the information on this display.	

Marked Point Information

The screenshot shows the 'View' menu with 'Marked Point Information' selected. A callout points to the 'Marked Point Information' icon in the toolbar. Another callout points to the 'Marked Point Information' dialog box, which displays the following data:

Labels:	I	II	III	IV	V
Latency (msec):	1.41	2.57	3.61	4.66	5.65
Amplitude (µV):	0.40	-0.14	0.07	0.33	0.34
Calculations:	III-I	V-III	V-I		
Interlatency (msec):	2.21	2.04	4.25		
Interamplitude (µV):	-0.33	0.27	-0.06		
Ratios:					
Amplitude (µV)					

At the bottom of the dialog box are 'OK' and 'Print' buttons. Callouts indicate: 'Click OK to close this display' and 'Click Print to print this display's content'. A note on the right says 'Check values for Labels, Calculations, and Ratios'.

Provides the latency and amplitude information for the marked points of the highlighted waveform on the active panel. Only one wave can be selected to access this function. See Understanding the AEP Collection Field Tree and Panels section for additional ways to access the Marked Point Information.

Interaural Latency / Amplitude Difference

The screenshot shows the 'View' menu on the left with the following options: Toolbars, Status Bar, Tabs, GraphMaster, Browser, Collection Views, Impedance Table, Records List, Record / Waveform Info, Marked Point Information, Interaural Latency / Amplitude Difference (highlighted), and Audiotape. A callout box points to the 'Interaural Latency / Amplitude Difference' option with the text 'Click View and Interaural Latency / Amplitude Difference ...'. Another callout box points to a small icon in the 'Collection Views' section with the text 'OR click this icon'. A third callout box points to the 'Interaural Marked Point Difference Table' dialog box with the text '... to get this table'.

Interaural Marked Point Difference Table

Labels:	I	II	III	IV	V
RE Latency (msec):		2.70	3.66	4.90	5.65
LE Latency (msec):	1.41	2.57	3.61	4.86	5.65
Interaural		0.12	0.04	0.04	0.00
RE Amplitude (uV):		0.26	0.56	0.22	0.09
LE Amplitude (uV):	0.40	-0.14	0.07	0.33	0.34
Interaural		0.42	0.49	-0.11	-0.25
Calculations:	III-I	V-III	V-I		
RE Intensity (msec):		2.00			
LE Intensity (msec):	2.21	2.04	4.25		
Interaural		-0.04			
RE Intensity (uV):		-0.47			
LE Intensity (uV):	-0.33	0.27	-0.06		
Interaural		-0.74			
Ratios:					
RE Amplitude (uV):					
LE Amplitude (uV):					
Interaural					

Buttons: OK, Print

Provides latency and amplitude information for the marked points of the highlighted waveform and calculates the interaural latency/amplitude difference.

Highlight one left ear waveform and one right ear waveform. Other than test ear, both waveforms have to be collected with the same critical collection parameters and must have similar marked points (for example: I, III, V). These waves can be on the same display panel or they can be on different panels.

Audiogram

Audiogram - 123123, Test,

One audiogram can be saved for a patient. The most recent entered audiogram will be saved for future review.

Audiogram Date: 8/15/2005

Frequency (Hz) Air Conduction Thresholds (dB)

	Left	Right
250	5	5
500*	10	10
750	5	5
1000*	5	5
1500	5	5
2000*	5	5
3000*	5	5
4000**	5	5
6000	5	5
8000	5	5

Hearing Threshold Average 6 6

Last modified: 3/15/2005

* Required frequencies for calculation of hearing threshold average
 ** 4000 Hz can be entered in lieu of 3000 Hz

Save Cancel Close

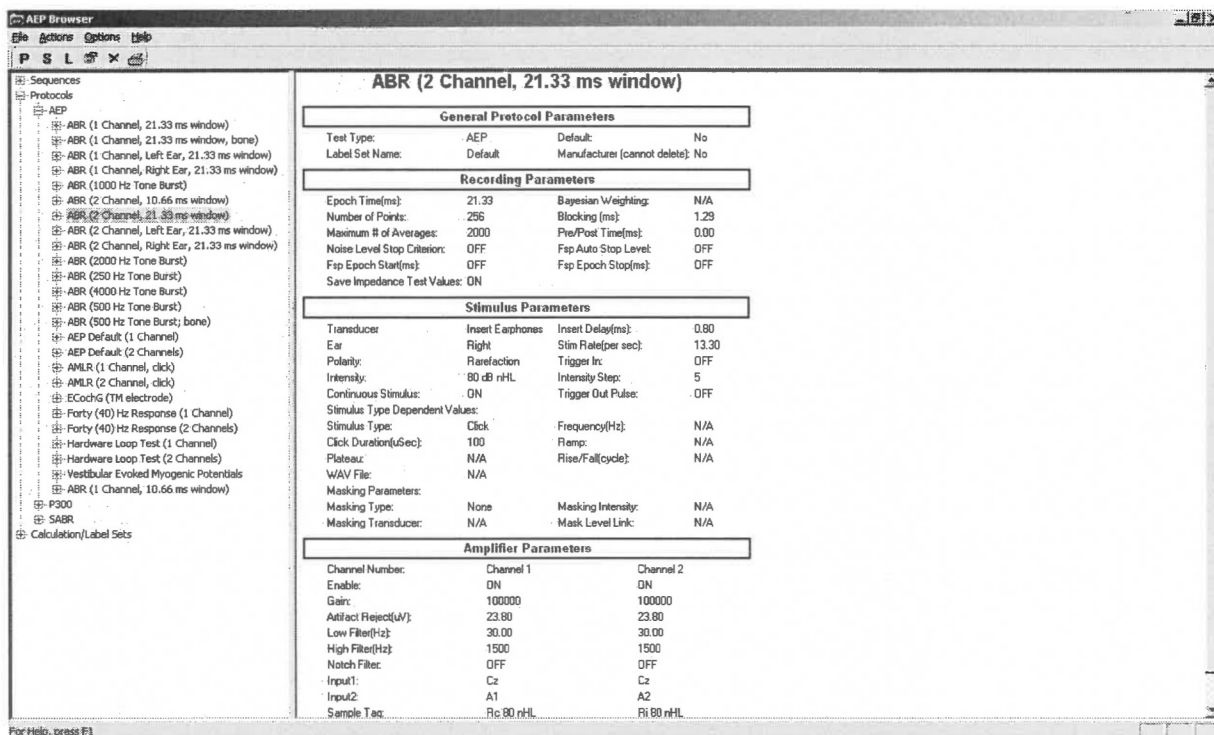
August, 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
25	26	27	28	29	30	31
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

Today: 2/8/2005

Component	Description
Audiogram Date and Calendar field	Displays the date you associate with the audiogram. Use this calendar to choose the date or type the date directly into this field. The software does not store multiple audiograms. Note: The most recent audiogram must be entered for Stacked ABR in order to calculate the interaural difference and the Hearing Threshold average must be ≤ 10 dB.
Air Conduction Thresholds fields	Enter the left and right air conduction thresholds for these frequencies by typing in the value. You must have a minimum of 4 frequencies to calculate the Hearing (Pure Tone) Threshold Average. 250 Hz is not included in the calculation.
Hearing Threshold Average item	Automatically calculates and displays the overall hearing threshold averages for the left and right ear (excludes 250 Hz threshold).
Last modified item	Displays the date of the last time the audiogram was modified in the AEP application.
Save command button	Closes this dialog box and saves any changes.
Cancel command button	Cancels any changes you have made without closing this dialog box.
Close command button	Closes this dialog box without making any changes.

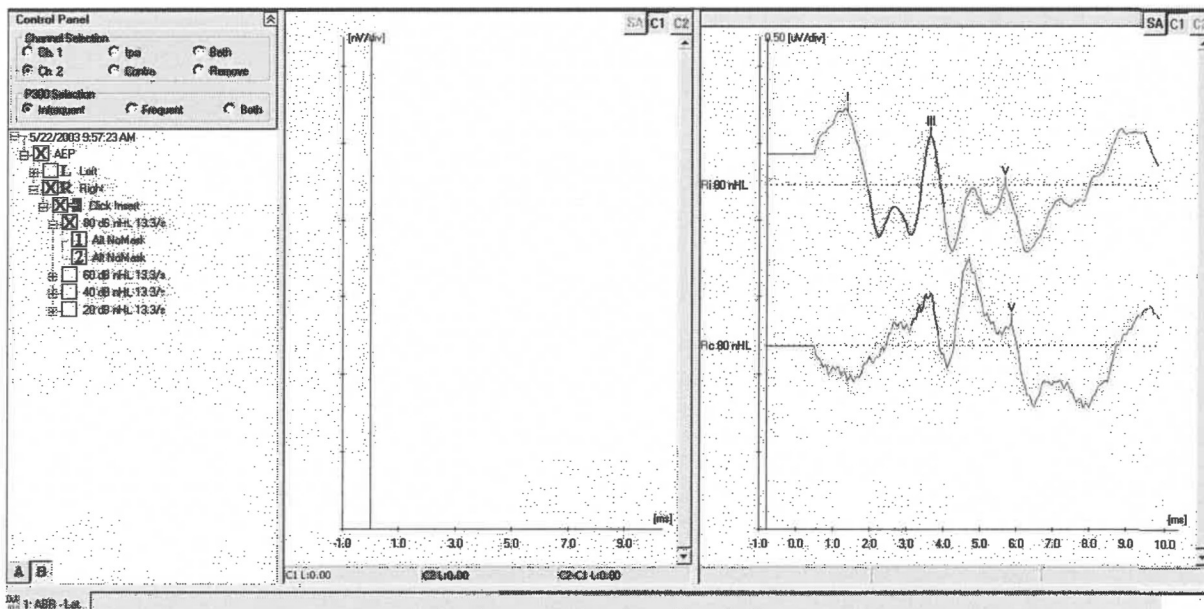
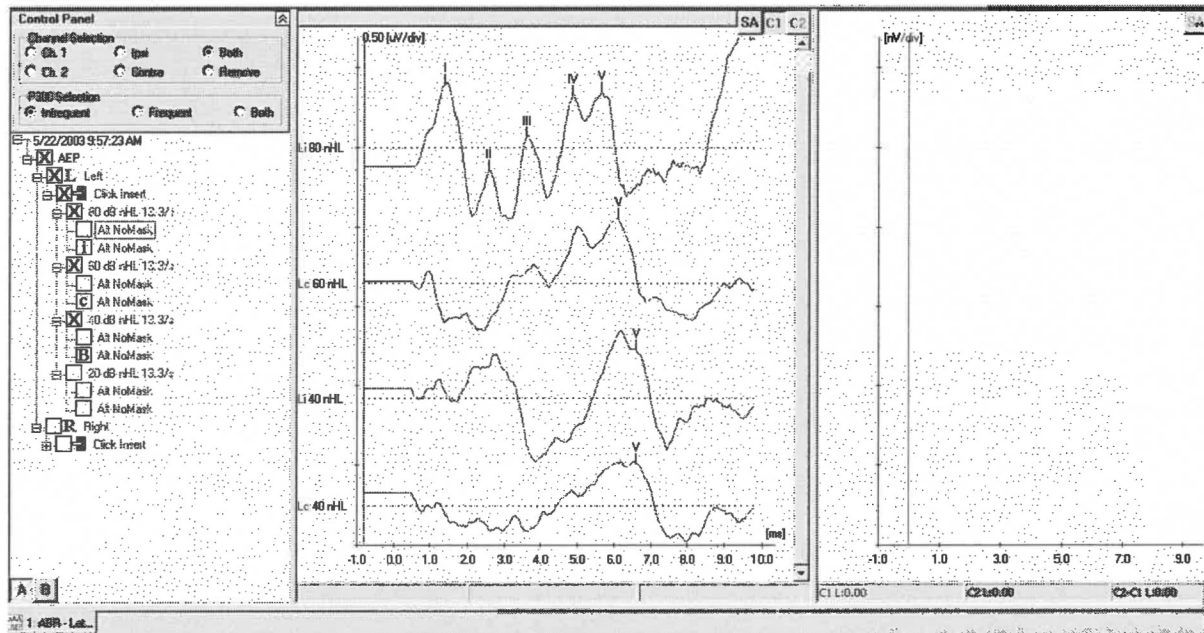
Browser



Select the desired protocol, sequence, or labels/calculations set from the field tree on the left. Once it is displayed on the right side, you can print it or delete it from the database by accessing the File menu.

Note: Some protocols, sequences, labels/calculation sets cannot be deleted.

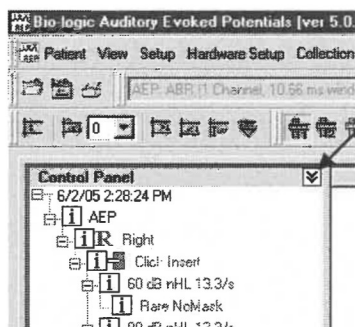
Understanding the AEP Collection Field Tree & Panels



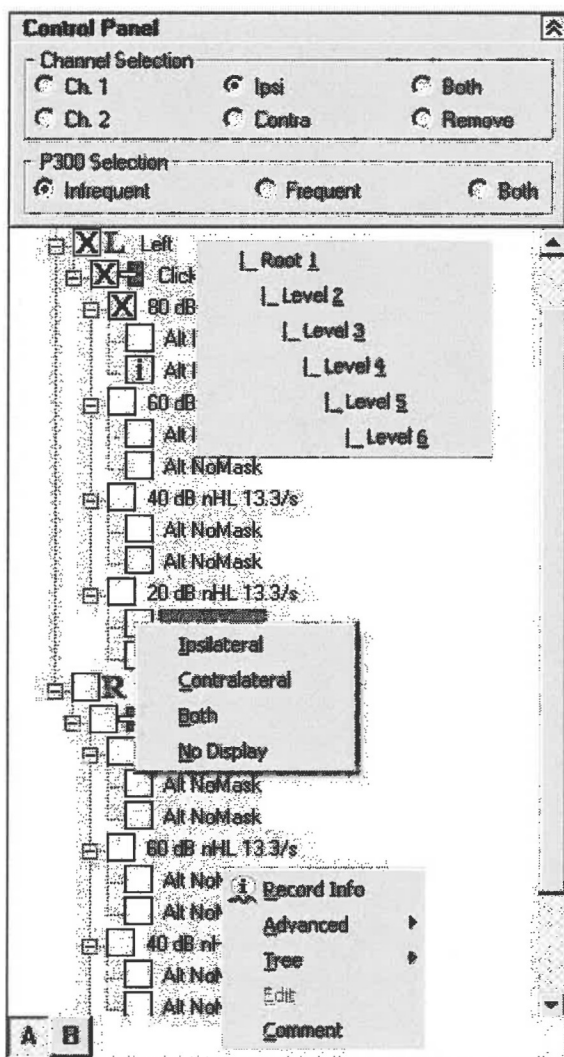
There are two Field Trees; one for panel A (left) and one for Panel B (right). The field tree displayed on the left is determined by the panel currently selected as the active panel. When collecting data, the waveforms will automatically display based on what is set in the Panel selection of the Default Display Parameters. However, before you print you can arrange the waveforms to meet your needs.

1. Select the Panel (A or B). Select the panel by clicking in a blank area of the panel or by clicking the A or B button at the bottom of the field tree. The panel you have selected will have a grey bar at the top of it and the corresponding panel button at the bottom of the field tree will be depressed.

2. Using the Channel Selection are at the top of the field tree, choose the channel to be displayed (Channel 1, Channel 2, Ipsi, Contra, or Both (ipsi and contra or channel 1 and channel 2) by clicking in the radio button.
3. Choose from the field tree the waveforms to be displayed. You can easily open the field tree level by clicking in the box with the “+” sign or by right clicking on the level and selecting which level you want to open. The levels for AEP test type records in order top to bottom are (these will vary for test type):
 - a. Date and Time of Test Session
 - b. Test Type
 - c. Stimulus Ear
 - d. Stimulus Type & Transducer Type
 - e. Stimulus Intensity & Rate
 - f. Polarity of Stimulus & Masking
4. Notice in Panel A (left panel) the following waveforms are displayed:
 - a. 80 dB 13.3 Alt No Mask – the ipsilateral waveform is displayed – this is indicated by the “i” in the box next to the record in the field tree.
 - b. 60 dB 13.3 Alt No Mask – the contralateral waveform is displayed – this is indicated by the “c” in the box next to the record in the field tree.
 - c. 40 dB 13.3 Alt No Mask – the ipsilateral and contralateral waveform is displayed – this is indicated by the “B” for Both in the box next to the record in the field tree.
5. Notice in Panel B (right panel) the following waveforms are displayed:
 - a. 80 dB 13.3 Alt No Mask – the Channel 1 waveform is displayed – this is indicated by the “1” in the box next to the record in the field tree. Determined by the Protocol Collection Parameters – Amplifier Tab; this is the contralateral waveform.
6. Notice that some of the boxes in front of the waveforms are empty. This is because they are not displayed on the corresponding panel. If a waveform is erased from the display, it is easy to display that waveform again by choosing the Channel selection and clicking in the box in front of the waveform level desired.
7. If you highlight a waveform by clicking on it in the Panel, the record will also be highlighted in the Field Tree. And if you highlight a record in the Field Tree by clicking on it, wave(s) will be highlighted on the Panel. You can **select multiple waveforms** by holding the Ctrl key and left clicking either on level six (polarity of stimulus & masking) of the field tree or on the waveforms in the panel.
8. The P300 Selection area lets you choose the frequent, infrequent or both waves to display on the active panel when you click in the letterbox next to a P300 record. For P300 records, the desired Channel Selection radio button must also be selected.
9. The Control Panel can be collapsed or expanded by clicking on the double arrows.

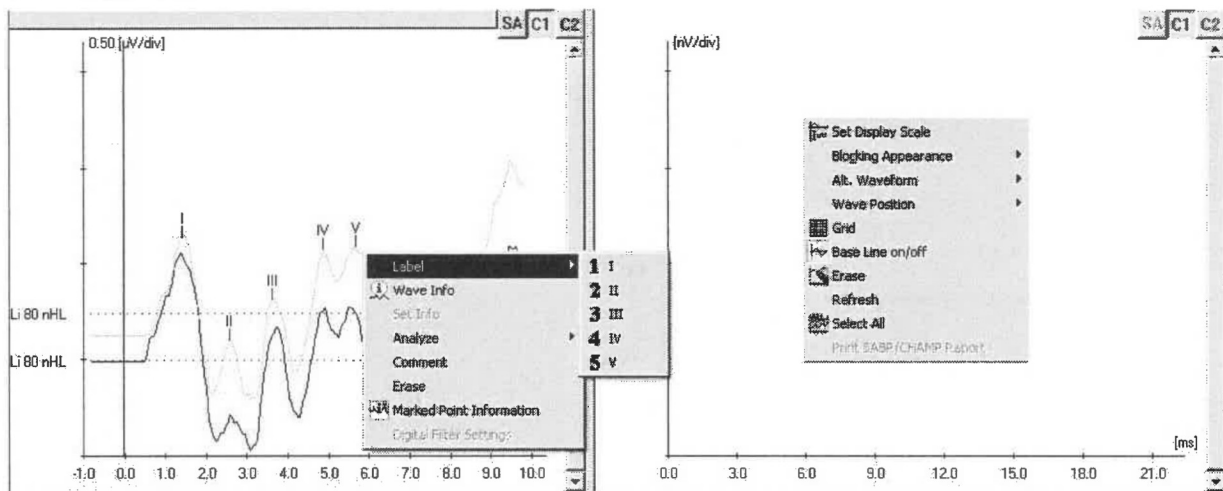


Toggle button to show or hide the Channel Selection and P300 Selection areas which shrinks or expands the size of the data tree.



9. Right Click on the Panel or levels 1-5 and a drop down of the field tree levels appears. This allows you to open up to the desired level by clicking on the level.
10. Right click on the box next to the waveform information and choose to display the Ipsilateral, Contralateral, Both, or No Display (remove the waveform from the panel). This is an alternate way of choosing waves for display rather than using the Channel Selection radio buttons.
11. Right click on the Polarity/Masking text in level 6, the options are:
 - a. Record Info displays the Record Information (See Record/Wave Info section).
 - b. Click Advanced and **Purge Item** to permanently delete a record (all channels). If a record is purged it is not retrievable.
 - c. Tree displays the field tree level as described in #9.
 - d. Edit – currently under development
 - e. Comment adds a comment to that specific record. This comment will display under the record in the Record List in the View menu.

MENUS AND TOOLBARS



Menu item	Description	
Right Click on Waveform and the window appears.		
Label	Lists labels that can be applied to the waveform, under the mouse cursor. Label will be applied at the location of the active cursor. See Adding Labels section.	
Wave info	Launches Wave Information dialog to review collection parameters. See Record / Waveform Info section.	
Set Info	For Stacked ABR/CHAMP data, launches a dialog description of the collected waves used to make calculations.	
Analyze	List of analysis comments. When applied, an abbreviation appears on the record in the field tree so that users can identify it easily. These analysis comments include:	
	Min. Response Level	Choose this option to define the waveform as the “Minimum Response Level” (that is, the lowest intensity where a response is observed.)
	Response	Choose this option to define the waveform as showing a “Response.”
	Threshold	Choose this option to define a waveform as representing the “Threshold.”
	No Response	Choose this option to show that the waveform exhibited no response to the test stimulus.
Comment	Launches an Edit Comment display to enter a comment for an individual selected waveform. Displayed in the Records List.	
Erase	Erases selected waveform(s) on active panel. This only erases the waveform from the display. It is not a permanent deletion of the waveform.	
Marked Point Information	Launches Marked Point Information display for the wave under the mouse cursor. See Marked Point Information section.	
Digital Filter Setting	Launches a read-only dialog box displaying the digital filter settings for this waveform as it is currently displayed on the panel.	

Menu item	Description			
Right Click on the Panel and the window appears.				
Set Display Scale	Launches the Set Display Scale dialog box. Scaling will be applied to selected waveform(s) on the panel. See Set Display Scale.			
Alt Waveform	Lists options related to displaying a waveform collected using an alternating polarity stimulus (See Alt Polarity Wave Display section). These options include:			
	Alternating only	Displays alternating polarity waveforms only.	Rarefaction on/off	Option to display rarefaction waveform.
	Rarefaction/Condensation only	Displays only individual Rarefaction and Condensation waveforms collected with alternating polarity.	Condensation on/off	Option to display condensation waveform.
	Alt/Rare/Cond Only	Displays Alternating, Rarefaction , and Condensation waveforms.	Differential on/off	Option to display the differential waveform (difference between rare and con).
	Alternating on/off	Option to display the alternating waveforms.		
Wave Position	Lists of options related to the waveform position appearance in the Panel (See Display menu & toolbar). These options include:			
	Align	Aligns all displayed waveforms on the active panel so their baselines are equally separated. Waveforms are still matched based on collection parameters.	Match	Matches all displayed waveforms on the active panel according to their critical collection parameters and leaves a small space between waveform groupings.
	Super-impose	Matches all displayed waveforms based on critical collection parameters and superimposes their baselines.	Move up	Moves the highlighted waveform(s) up in large increments. Selection of the up arrow key on the keyboard or clicking on and dragging the wave up on the active panel will move the wave in smaller increments.
	Move down	Moves the highlighted waveform(s) down in large increments. Selection of the down arrow key on the keyboard or clicking on and dragging the wave down on the active panel will move the wave in smaller increments.	Transfer	Transfers selected waveform(s) from the active panel to the other panel.
	Erase	Erases selected waveform(s) on active panel. This only erases the waveform from the display. It is not a permanent deletion of the waveform.		

MENUS AND TOOLBARS

Component	Description
Grid	Displays vertical lines per division on the panel.
Baseline On/Off	Displays a baseline through the waveform.
Erase	Erases selected waveform(s) on active panel. This only erases the waveform from the display. It is not a permanent deletion of the waveform.
Refresh	If the waveforms have been manually moved to a different location on the panel, refresh will move the waveforms back based on the wave position algorithm in effect.
Select All	Highlights all of the waveforms in the panel. Any action that you perform after selecting this option affects all of the waveforms.

Incorporate Results into the AEP Report

After data has been collected and displayed on the panels, Click on Open Patient icon , Click on Database Button and Test Results tab.

To enter Results that will appear in the AEP report(s), either type in the results in the Results window or Click Insert Template and choose the desired template.

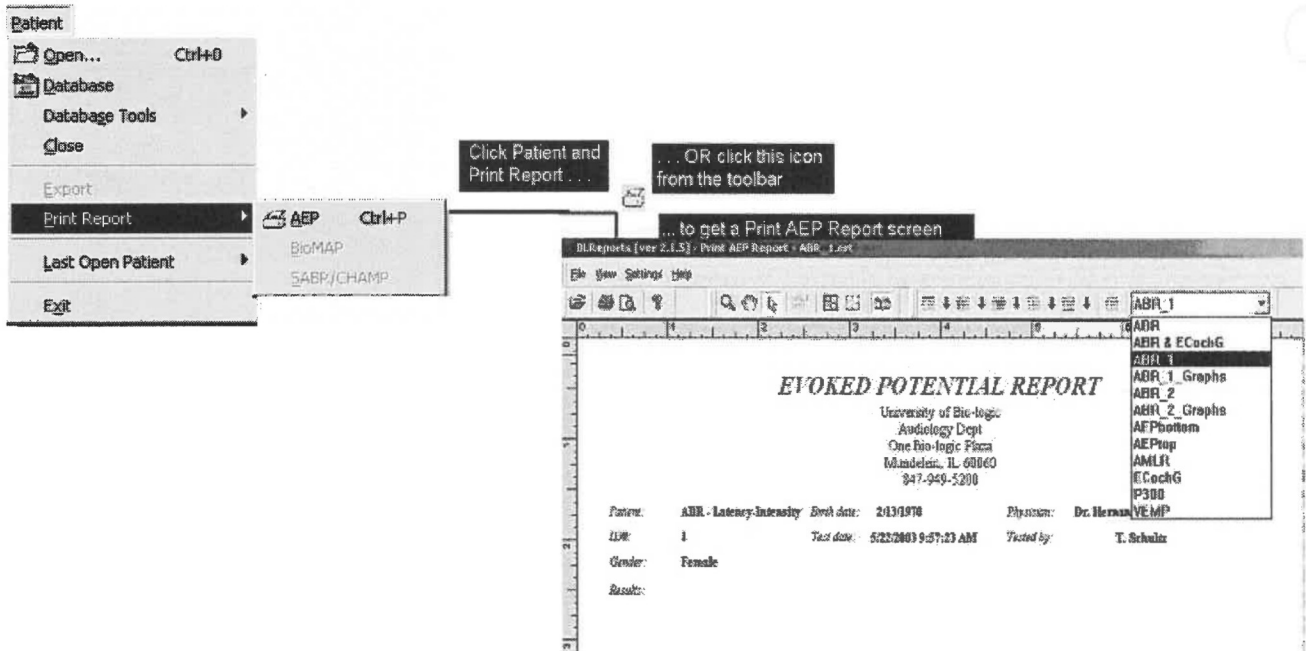
See the Patient Setup – Template section of this document for instructions on creating templates.

These results appear in reports that have the results section incorporated into their layout (for example: ABR_1, ABR_2, ABR_1_Graphs, or ABR_2_Graphs).

If the data displayed on the panels is a combination of test dates, verify that the test date displayed in the Test Results tab is the most recent test date of the data on the panel. The result incorporated in the report will be the result from the most recent test date of the tests on the panel. If the test date displayed is not the most recent test

date, click on the Table View  icon. Then double click on the patient test record with the most recent test date that is currently represented on the patient window.

Print AEP report



To choose a report other than the default report, click the drop down arrow next to the report name to access the other reports.

Note: You must choose a report that matches the data on the screen. The Report Templates are designed to match the label set of the marked points in the protocol. Use of an inappropriate report template can result in the mislabeling of the marked points in your report. For example, if you use and ABR & ECoG label set as part of the protocol, you must use the ABR & ECoG report template.

Modify the Waveform Panels

In the Collection or Review Data screen

1. The panels on the report are representative of the panels on the collection or review screen. To efficiently use the panel space, click on Match to align the waveforms (see Display Menu and Display Toolbar section). The panels grow to fit the size of the waveforms. Select all waveforms and scale the waveforms so that the panel does not scroll. This will reduce the panel size on the print out. This can avoid issues with the pagination of the reports.

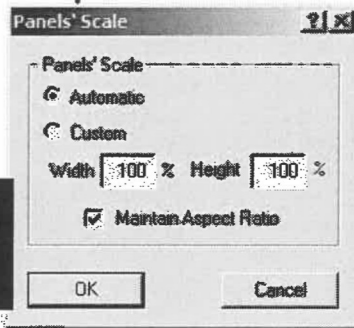
In the Report Preview screen

2. An additional option for resizing the panels is to use Panels' Scale. Click on Settings, choose Panels' Scale and then Custom. To make the panels smaller, type in a smaller number in width and height boxes. If you want to only modify the height of the panels, deselect the Maintain Aspect Ratio and type in a smaller number in the height box.

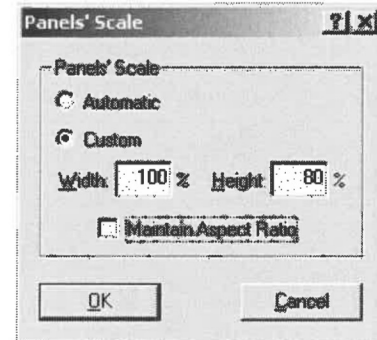


Click Settings and
Panel Scale ...

... to get the
Panel Scale
dialog box

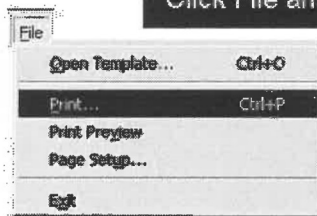


Adjust the Panel's Scale as
displayed below to reduce the
panel height.



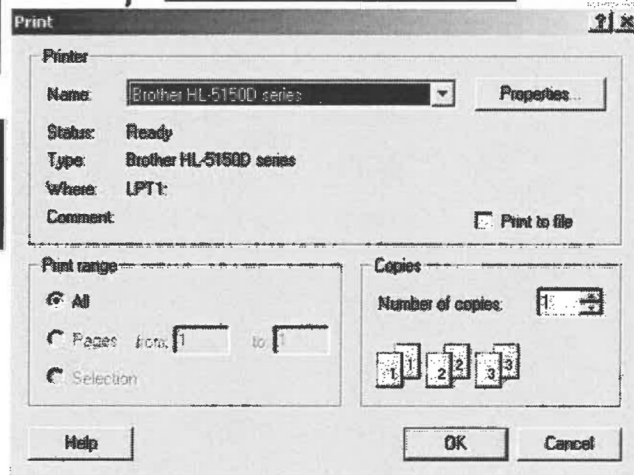
To Print the Report

Click File and Print ...



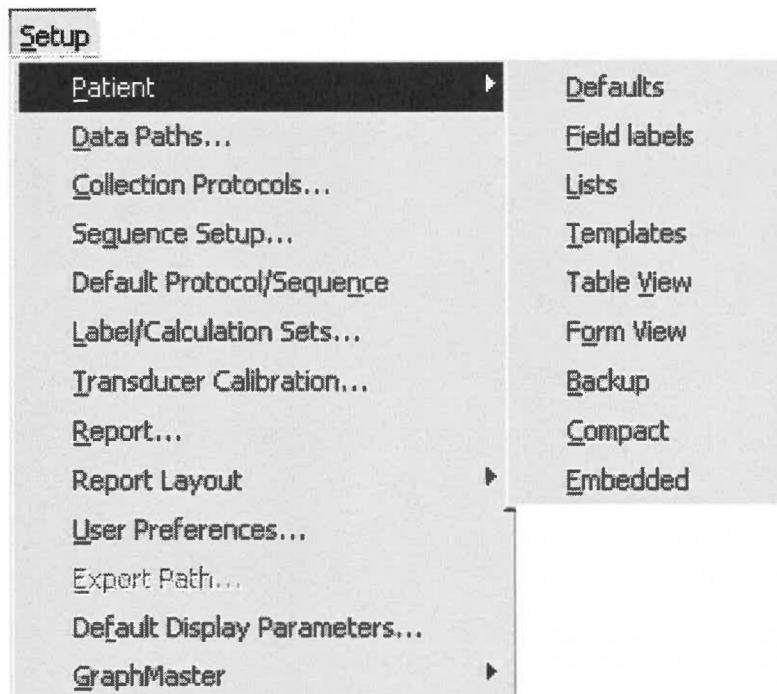
... to get a Print dialog box

Use this dialog box
to set print criteria
and start output



Note: For more information about this dialog box, check the documentation that came with your printer.

AEP Setup



The Setup menu is the third of the AEP main menu items.

Patient Setup Defaults

Patient Setup - Defaults

Default Open Patient Location: AEP

Default Archive Patient Location: archive 2005

Default Copy Patient Location:

Master Database Location:

Default Backup Location: C:\P&T\Backup

First Sort Order: Test Date

Ascending A → Z
Descending Z → A

Second Sort Order:

Ascending A → Z
Descending Z → A

Third Sort Order:

Ascending A → Z
Descending Z → A

Open Lists & Templates Location: Global Local

Display Patient Data: This Application Only All Bio-logic Applications

Save Close

To launch this dialog box, click Setup, Patient, and Defaults. The table below lists brief descriptions of this feature's components.

Component	Description
Default Open Patient Location	Designated data path location for the patient data. The default location is AEP; however, another location can be chosen from the data path drop down list. See Setup – Data Paths for more information.
Default Archive Patient Location	Designated data path location for the Archived patient data. The default location can be chosen from the data path drop down list. See Setup – Data Paths for more information.
Default Copy Patient Location	Designated data path location for the Copied patient data. The default location can be chosen from the data path drop down list. See Setup – Data Paths for more information.
Master Database Location	Designated data path location for the Master Database which retains where archived patients are located. The default location can be chosen from the data path drop down list. See Setup – Data Paths for more information.
Default Backup Location	Designated data path location for the Backup patient data saved in XML format. Browse to the desired location.

Patient Setup - Defaults [?] [X]

Default Open Patient Location: AEP

Default Archive Patient Location: archive 2005

Default Copy Patient Location:

Master Database Location:

Default Backup Location: C:\P&TI\Backup ...

First Sort Order: Test Date

Ascending A → Z
Descending Z → A

Second Sort Order:

Ascending A → Z
Descending Z → A

Third Sort Order:

Ascending A → Z
Descending Z → A

Open Lists & Templates Location: Global Local

Display Patient Data: This Application Only All Bio-logic Applications

Save Close

Component	Description
Sort Order fields	Determines the order that the patient data will be sorted in the Patient Database.
Sort radio buttons	The radio buttons work with the Sort Order fields to set the criteria the AEP program uses to sort patient files.
Open Lists & Template Location radio buttons	Click one of the radio buttons to determine the locations from which the lists and templates on this computers hard drive will be accessible. Global = network system wide; Local = this computer only.
Display Patient Data radio buttons	If more than one software application on the computer uses the P&TI database (e.g. ABAer and AEP both use P&TI), "This Application Only" will display only the patients with data collected in AEP. "All Bio-logic Applications" will display all patients from all software applications using P&TI (e.g. all patients with data collected in ABAer and AEP).

Patient Setup – Field Labels

Patient Setup - Field Labels ? | X

Open Location:
☐ Global ☒ Local

Labels

Field Name	Field Label
Activation	Activation
Address1	Address1
Address2	Address2
Age	Age at Test
AgeUnits	Age Units
Analyzed	Analyzed
AOAETestType	AOAE Test Type
AOAEUnitType	AOAE Box Type
AppointmentDate	Appointment Date
Archived	Archived
ArchiveDate	Archive Date
ArchiveDisk	Archive Disk
ArchiveTime	Archive Time
Birthdate	Birthdate
City	City
Comment	Comment
Comments	Comments
Conclusion	Conclusion

To launch this dialog box, click Setup, Patient, and Field Labels. The table below lists brief descriptions of this feature's components.

Note: Changes to field labels will only apply to test records collected after this change is made. Previously collected records will display the field labels that were current at the time of data collection.

Component	Description
Field Name column	Contains a list of all the field options for the Form View and Table View features.
Field Label column	Contains a list of the label that appears for each field. To change a field label, locate the desired field in the Field Name column and then type the desired label in the Field Label section.
Save	Makes any change permanent.
Save to Global	Makes any change permanent and effective for the entire system so these labels are accessible to other networked systems.
Close	Closes the Patient Setup – Field Labels dialog box without saving any changes.

Patient Setup – Lists

To launch this dialog box, click Setup, Patient, and Lists. The table below lists brief descriptions of this feature's components.

Component	Description
Select List field	Contains these list options: Medication, Physician (for Patient info), Physician-T (for Test info), Reason, Referred By, Risk Factors, Test Facility, Test Location, Tested By, Text Combo(s), and User Memo Combo(s). To add to a list, choose the list and type the items in the list. To delete an item from a list, highlight the item (i.e. physician's name) and click the delete button on the keyboard.
Save	Makes any change permanent.
Save to Global	Makes any change permanent and effective for the entire system so these lists are accessible to other networked systems.
Close	Closes the Patient Setup – Lists dialog box without saving any changes.

Patient Setup – Template

Patient Setup - Templates

Open Location: ☐ Global ☒ Local

Template Group: Results

Template Name: Normal ABR Delete

Template Text: The ABR was within normal limits bilaterally.

Save Save to Global Close

To launch this dialog box, click Setup, Patient, and Templates. The table below lists brief descriptions of this feature's components.

Component	Description
Template Group field	Contains this list of Template options: Conclusion, Interpretation, Recommendation, Results. To setup Results Templates that you can select and print in the AEP Report: —Choose Results in the drop down menu on right side. —Type the name you want in the Template Name window (for example: normal, severe, or auditory neuropathy). —Type the results for that template in the Template Text window. After data is collected: —Click on Open Patient (window where you entered the patient name) —Click Database —Click Test Results tab —Click Insert Template —Then within the Patient Report print preview, Select Template Name with desired results.

Patient Setup - Templates [?] [X]

Open Location: ☐ Global ☒ Local

Template Group: Results

Template Name: Normal ABR [v] [Delete]

Template Text: The ABR was within normal limits bilaterally.

[Save] [Save to Global] [Close]

Component	Description
Open Location radio buttons	Click on one of the radio buttons to determine the location for your patient file.
Template Name	List of names you can choose from to edit a template. Type in a desired template name.
Delete command button	Deletes a Template Name from the list.
Template Text field	Holds the text that applies to the template name you selected. For a new template, type the text in this area.
Save	Makes any change permanent.
Save to Global	Makes any change permanent and effective for the entire system so these templates are accessible to other networked systems.
Close	Closes the Patient Setup – Templates dialog box without saving any changes.

Patient Setup – Table View

Patient Setup - Table View ? [X]

Open Location: ☐ Global ☒ Local

Color settings dialog

Available Fields

- Activation
- Address1
- Address2
- Age at Test
- Age Units
- Analyzed
- AOA Box Type
- AOA Test Type
- Appointment Date
- Archive Time
- Archived
- Associated File
- City
- Comment
- Comments
- Conclusion
- Country
- Discharge Date
- Ear
- End Time
- Exported
- File Status
- Gestational Age at Birth in We
- Handedness
- Height
- History

Add >>

<< Remove

Table View Fields

- Patient ID
- Last Name
- First Name
- Birthdate
- Sex
- Physician
- Test Date
- Tested by
- Archive Date
- Archive Disk

Move Up Move Down

Save Save to Global Close

To launch this dialog box, click Setup, Patient, and Table View. The table below shows columns of information for test records.

Component	Description
Open Location radio buttons	The radio buttons let users setup changes to either the system in use (Local) or all databases within a system network (Global).
Color settings dialog	Click this to launch a dialog box that lets you define the color of the record highlighted for the Table View.
Available Fields	Lists all the fields currently available within the AEP program. You can move these fields to and from the list of Table View fields with the Add and Remove buttons.
Table View fields	Lists all the fields that you can choose to display in a table view. Select the fields that you want to see from the list of Available Fields. You can move these fields to and from the list of Available Fields with the Add and Remove buttons. The top fields will appear on the left side of the Table View and the bottom fields will appear on the right side of the Table View.
Add and Remove buttons	These buttons move fields between the list of Available Fields and the list of Table View fields.
Move Up and Move Down buttons	These buttons adjust the order in which the fields appear.
Save	Makes any change permanent.
Save to Global	Makes any change permanent and effective for the entire system.
Close	Closes the Patient Setup – Table View dialog box without saving any changes.

Patient Setup – Form View

Patient Setup - Form View

Open Location: ☐ Global ☒ Local ☐ Snap to Grid

Patient Info | Test Info | Test Results

Patient ID: Last Name: First Name: Birthdate: Sex:

Physician: Gestational Age at Birth in Weeks:

Address1:

Address2:

City: State: Postal Code:

Telephone:

History:

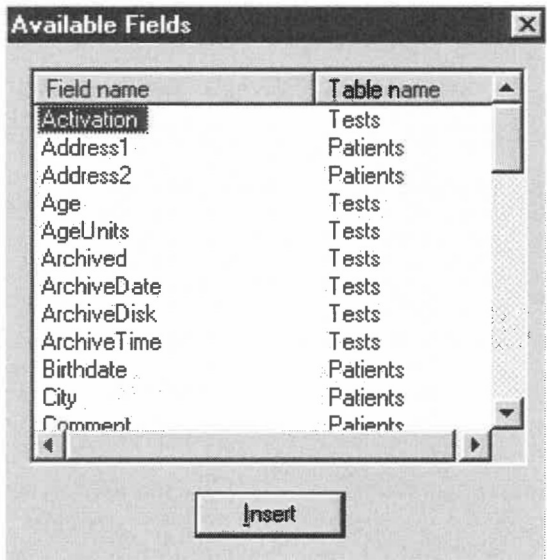
Available Fields

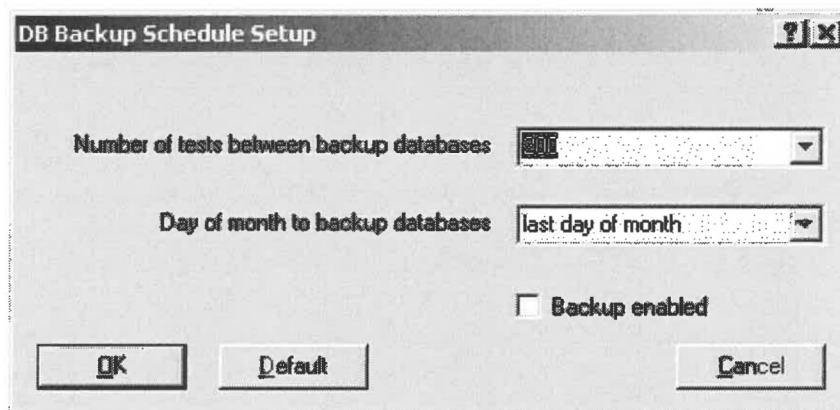
Field Label	Table name
Activation	Tests
Age at Test	Tests
Age Units	Tests
Analyzed	Tests
ADAE Box Type	Tests
ADAE Test Type	Tests
Appointment Date	Patients
Archive Date	Tests
Archive Disk	Tests
Archive Time	Tests
Archived	Tests
Associated File	Tests

To launch this dialog box, click Setup, Patient, and Form View. The table below lists brief descriptions of this feature's components.

Component	Description
Open Location radio buttons	The radio buttons let users setup changes to either the system in use (Local) or all databases within a system network (Global).
Use Default button	Inserts the default manufacturer formats for the fields in all tab menus simultaneously.
Tab Order	Click on this button to set the tab order for the P&TI program. This sets the tab order from one field to the next.

MENUS AND TOOLBARS

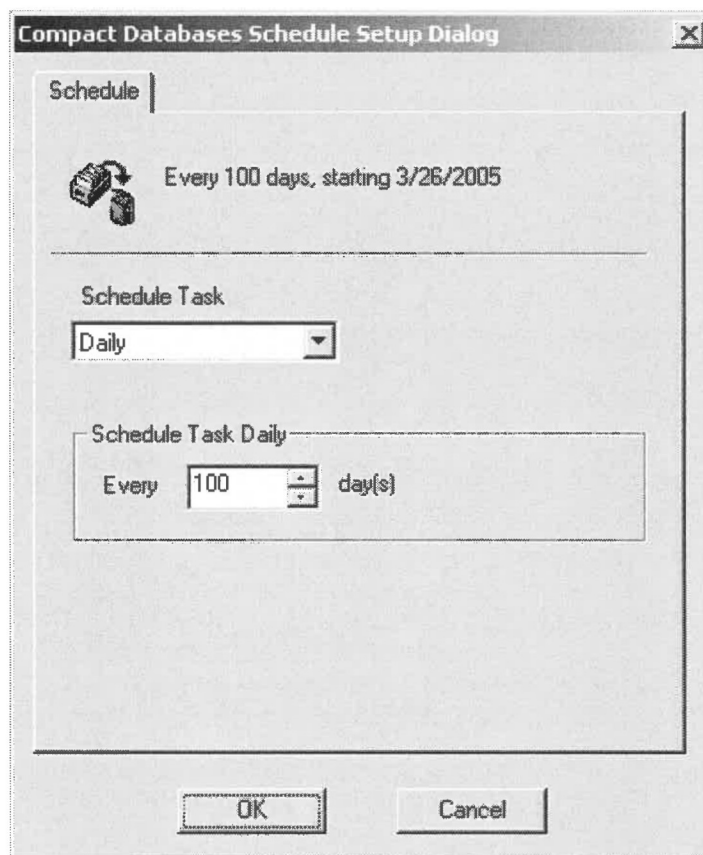
Component	Description																										
Snap to Grid checkbox	Activates (checkmark appears) or deactivates (no checkmark appears) the Snap to Grid Settings command button.																										
Snap to Grid Settings command button and dialog box	Click this checkbox until a checkmark appears and all components automatically align to a standard grid. Click this checkbox until no checkmark appears and components alignment is freeform (that is, uses no grid).																										
Tabs	Patient Information tab: Contains the Patient Demographics Test Information tab: Contains the Test Info from the data Test Results tab: Contains the Test Results information																										
Save button	Saves the entries you make in any tab.																										
Insert Field	Lists all the fields available in the system. Use Patient fields for Patient Info tab and Tests fields for Test Info and Test Results tab. To add a field to a tab in the Form View, highlight a field name in the available fields list, click Insert, position +A at the desired location and click to set the field in place.  <table border="1" data-bbox="727 919 1224 1312"> <thead> <tr> <th>Field name</th><th>Table name</th></tr> </thead> <tbody> <tr><td>Activation</td><td>Tests</td></tr> <tr><td>Address1</td><td>Patients</td></tr> <tr><td>Address2</td><td>Patients</td></tr> <tr><td>Age</td><td>Tests</td></tr> <tr><td>AgeUnits</td><td>Tests</td></tr> <tr><td>Archived</td><td>Tests</td></tr> <tr><td>ArchiveDate</td><td>Tests</td></tr> <tr><td>ArchiveDisk</td><td>Tests</td></tr> <tr><td>ArchiveTime</td><td>Tests</td></tr> <tr><td>Birthdate</td><td>Patients</td></tr> <tr><td>City</td><td>Patients</td></tr> <tr><td>Comment</td><td>Patients</td></tr> </tbody> </table>	Field name	Table name	Activation	Tests	Address1	Patients	Address2	Patients	Age	Tests	AgeUnits	Tests	Archived	Tests	ArchiveDate	Tests	ArchiveDisk	Tests	ArchiveTime	Tests	Birthdate	Patients	City	Patients	Comment	Patients
Field name	Table name																										
Activation	Tests																										
Address1	Patients																										
Address2	Patients																										
Age	Tests																										
AgeUnits	Tests																										
Archived	Tests																										
ArchiveDate	Tests																										
ArchiveDisk	Tests																										
ArchiveTime	Tests																										
Birthdate	Patients																										
City	Patients																										
Comment	Patients																										
Delete button	Deletes a field you have highlighted from a tab.																										
Close button	Closes the Patient Setup – Form View display.																										

P&TI Database Backup Schedule Setup

To launch this dialog box, click Setup, Patient, and Backup. The table below lists brief descriptions of this feature's components.

Component	Description
Number of tests between backup databases	Backup will occur after the number of tests is collected. Choose the number you want from the list.
Day of month to backup databases	List of possible days when the program will automatically backup databases. When enabled (checkmark appears), choose the backup option you want from the list.
Backup enabled checkbox	When enabled (checkmark appears), the AEP program automatically backs up databases per the Day of month to backup databases field.
OK command button	Closes the dialog box and saves any changes you have made.
Default command button	Returns settings to manufacturer defaults.
Cancel command button	Closes the dialog box without making any changes.

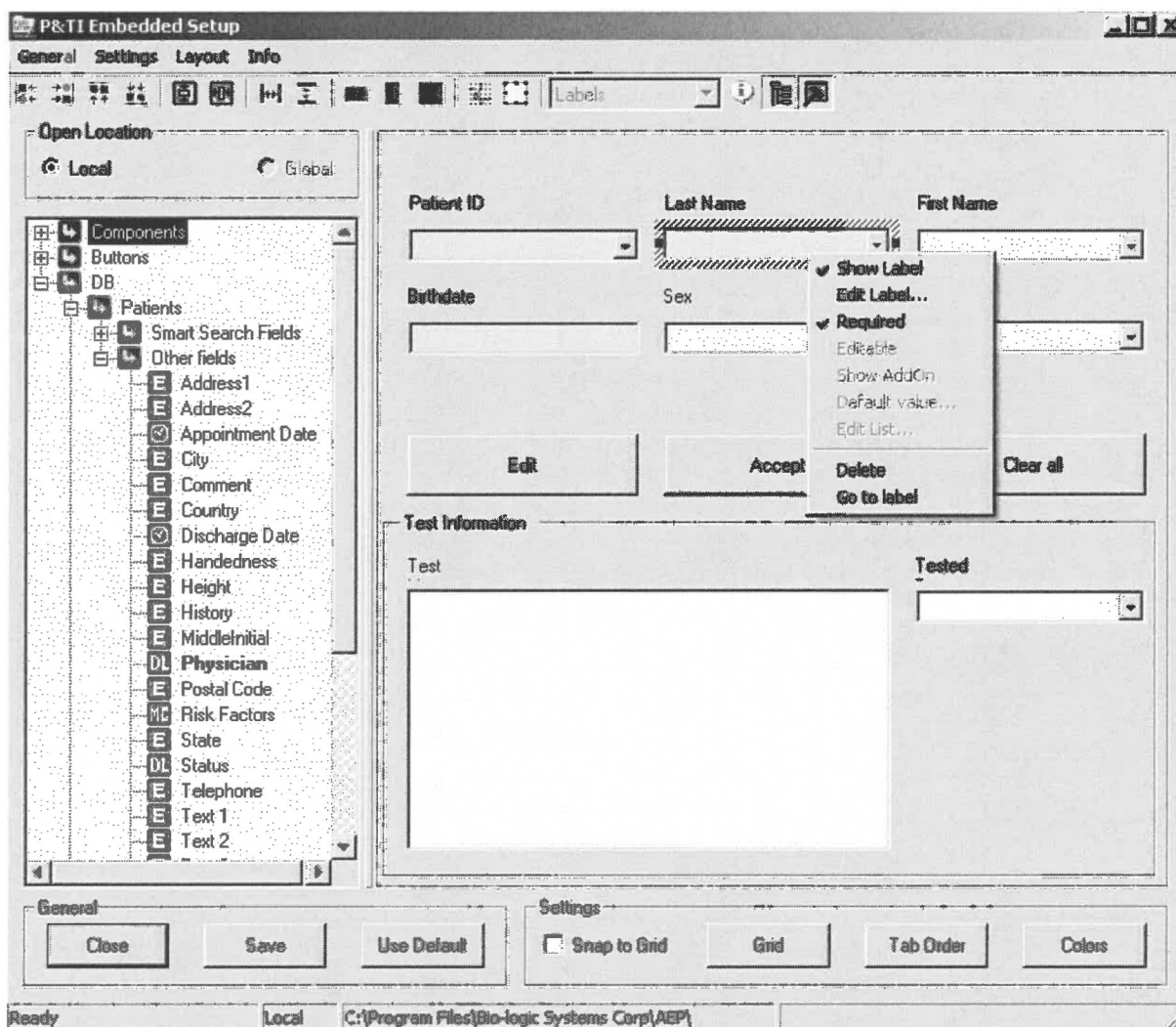
Compact Databases Schedule Setup



Compact Database is a database maintenance tool that can improve efficiency of the database functions in the application especially if you frequently delete records after archiving or copying tests or patients. It should be used in the event that the application seems to be slower than it was previously at accessing information within the database. To launch this dialog box, click Setup, Patient, and Compact. The table below lists descriptions of this feature's components.

Component	Description
Current schedule info	Displays the schedule you are currently using for compacting databases.
Schedule Task field	Defines the units you want to use for scheduling the task frequency (e.g. daily, weekly)
Schedule Task Daily field	Determines the frequency with which the database will be compacted.
OK command button	Closes the dialog box and saves any changes made.
Cancel command button	Closes the dialog box without making any changes.

P&TI Embedded Setup



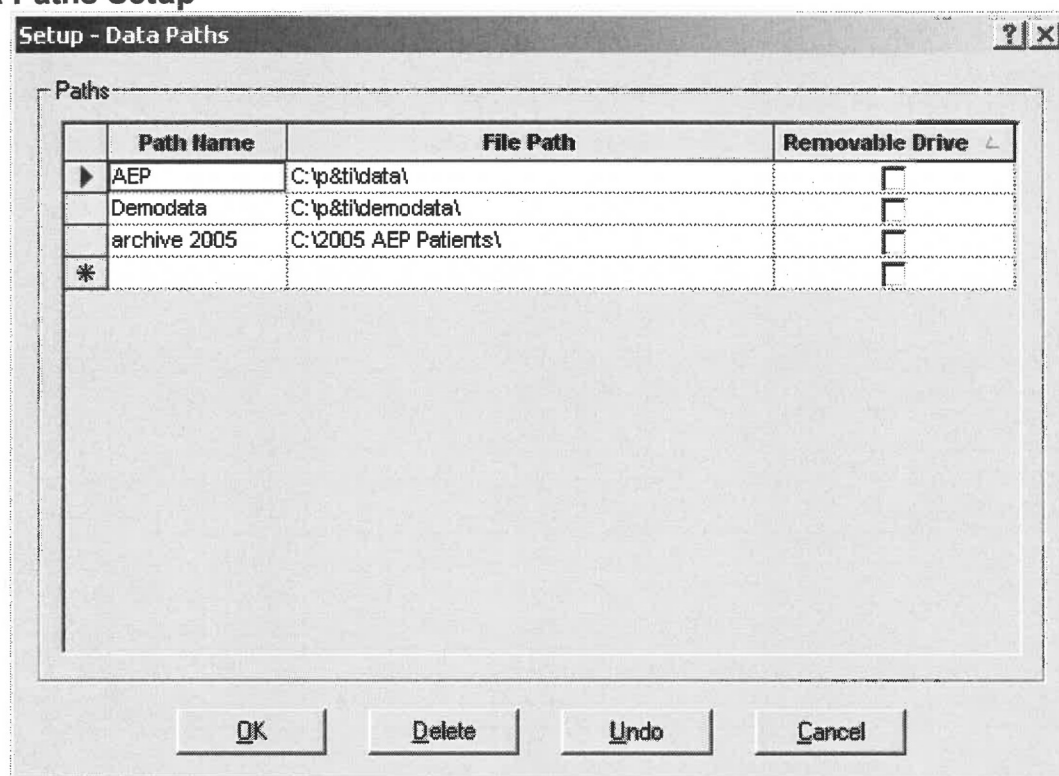
Allows user to customize the Open Patient dialog box by adding fields, designating required fields, and modify field colors. To launch this dialog box, click Setup, Patient, and Embedded. The table below lists descriptions of this feature's components. The layout buttons become accessible when one field or more than one field is selected.

Component	Description
General menu	This menu contains these items: Save, Save to Global, Use Default, Close.
Settings menu	This menu contains these items: Tab Order, Minimal Size, Info Mode, Colors, Smart Search, Lock Demographics, Grid, Snap to Grid, Toggle Tree and Toggle Buttons.
Layout menu	This menu contains these items: Align Left, Align Right, Align Top, Align Bottom, Center Vertical, Center Horizontal, Space Across, Space Down, Make Same Width, Make Same Height and Make Same Size. See icon descriptions.
Info menu	This menu contains these items: Legend; About.

Icons			
	Align Left: Aligns components selected on the setup template to the left.		Align Right: Aligns components selected on the setup template to the right.
	Align Top: Aligns components selected on the setup template to the top.		Align Bottom: Aligns components selected on the setup template to the bottom.
	Center Vertical: Centers components selected on the setup template vertically.		Center Horizontal: Centers components selected on the setup template horizontally.
	Space Across: Spaces components selected on the setup template evenly across the screen.		Space Down: Spaces components selected on the setup template evenly up and down the screen.
	Make Same Width: Makes components selected on the setup template the same width.		Make Same Height: Makes components selected on the setup template the same height.
	Make Same Size: Makes components selected on the setup template the same size.		Toggle Grid: Shows or hides a grid.
	Toggle Minimal Size: Shows or hides a size control box on the open dialog template. The size is the smallest that this dialog can be sized.		Select Info Model: Contains a list of information types that can be displayed on the fields positioned on the embedded setup template.
	Toggle Info Model: Activates or deactivates the Info Model field.		Shows or hides the tree
	Shows or hides the General and Settings command buttons at the bottom of the dialog window.		
Component	Description		
Open Location radio buttons	The radio buttons let users setup changes to either the system in use (Local) or all databases within a system network (Global).		
Component tree	Lists components you can add to operating tabs.		

Component	Description
Mouse menu	This menu contains these items: Show Label, Edit Label, Required, Editable, Show Add-on, Default value, Edit List, Delete and Go to label. To see this menu: —Click a component. —Right-click the mouse on the field label.
Close command button	Closes the Setup screen without making any changes.
Save command button	Saves any changes you make without closing the dialog box.
Use Default command button	Sets all components in the Setup screen to the manufacturer default.
Snap to Grid checkbox	Click this checkbox until a checkmark appears and all components automatically align to a standard grid when moved. Click this checkbox until no checkmark appears and components alignment is freeform (that is, uses no grid).
Grid command button	Shows or hides a grid on the Setup screen.
Tab order command button	Shows or hides a tab order for the components on the Setup screen. Click on the fields in the tab order you desire to set the tab order.
Colors command button	Click this to launch a dialog box that lets you assign colors to the components on the Setup screen based on its field type.

Data Paths Setup



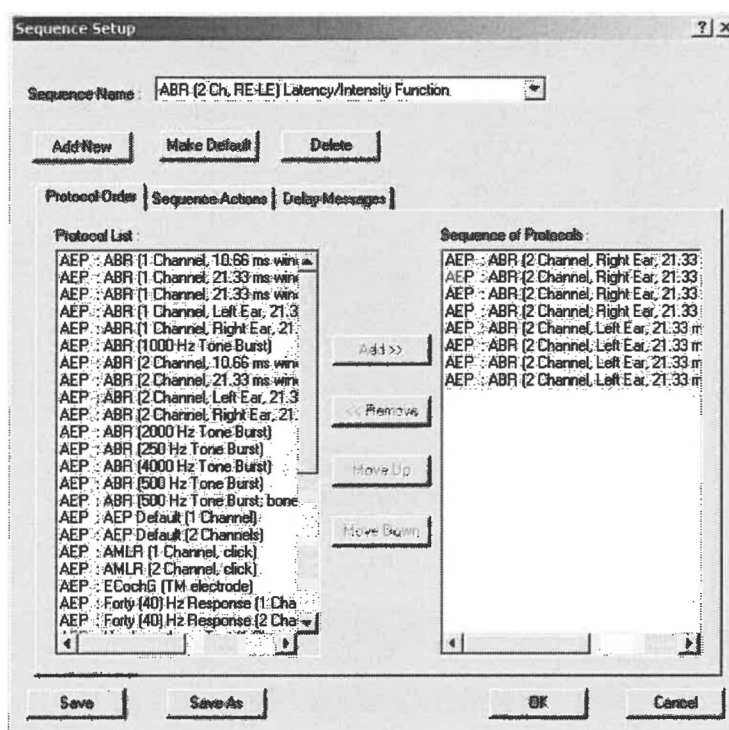
Clicking on the Data Paths menu item launches the Setup - Data Paths dialog box. This dialog box lets you enter or edit Path Name labels and their corresponding database drive paths for use in the Patient and Test Information program. These Path Name labels become important when you work with the Patient Setup - Defaults screen

Collection Protocols

See Selecting, Checking, and Changing Collection Protocols section.

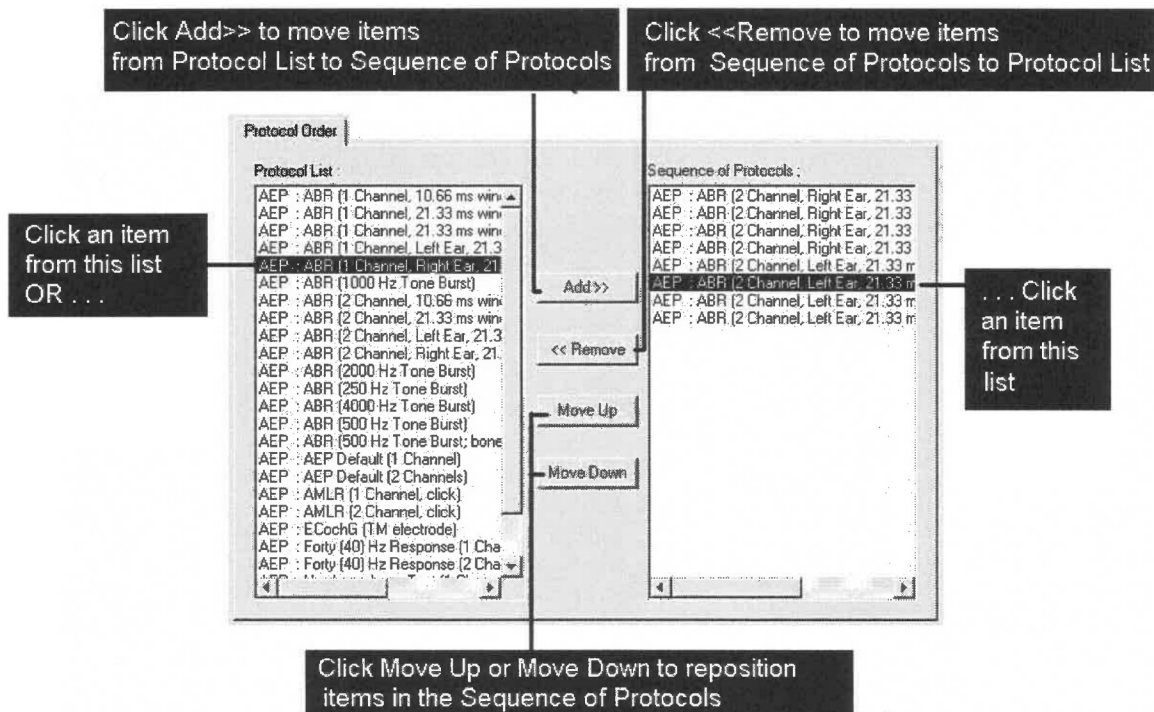
Sequence Setup

The Sequence Setup item launches a set of tabs that allows you to create a new sequence of protocols, set a sequence as a default, or delete a sequenced from AEP. This setup dialog can also be used to change the sequence of the protocols being run, modify the sequence actions for the protocol, and format delay messages for that appear before collection starts with a protocol in the sequence. This tool contains command buttons and three tabs that you can use.



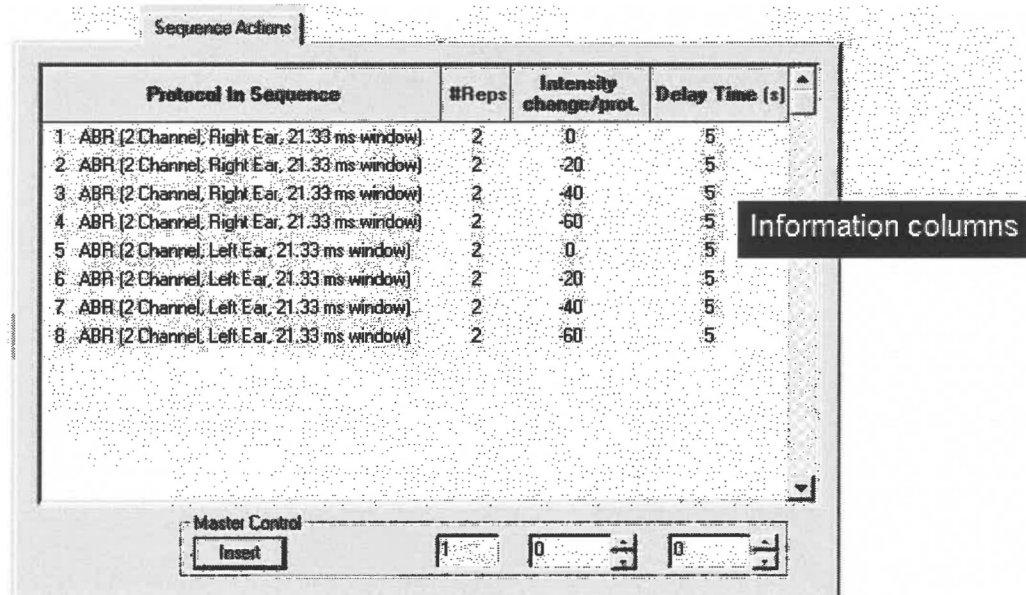
Component	Description
Sequence Name field	Lists the sequences that already exist in AEP.
Add New command button	Launches a New Sequence Name dialog box and saves a sequence under a new name.
Make Default command button	Makes any sequence of protocols the system default whenever you launch the application.
Delete command button	Removes any sequence you choose from the list in the Sequence Name field. Note: Some sequences cannot be deleted.
Save command button	Saves any changes you make on the tabs to the sequence selected.
Save As command button	Saves any changes made on the tabs to a new sequence name. The program retains the original sequence with its original parameters.
OK command button	Closes the Sequence Setup screen and implements any changes you have made. The program uses these changes for subsequent tests in the session. To save them permanently, you must use the Save or Save As commands.
Cancel command button	Closes the Sequence Setup screen without implementing any changes.

Protocol Order tab



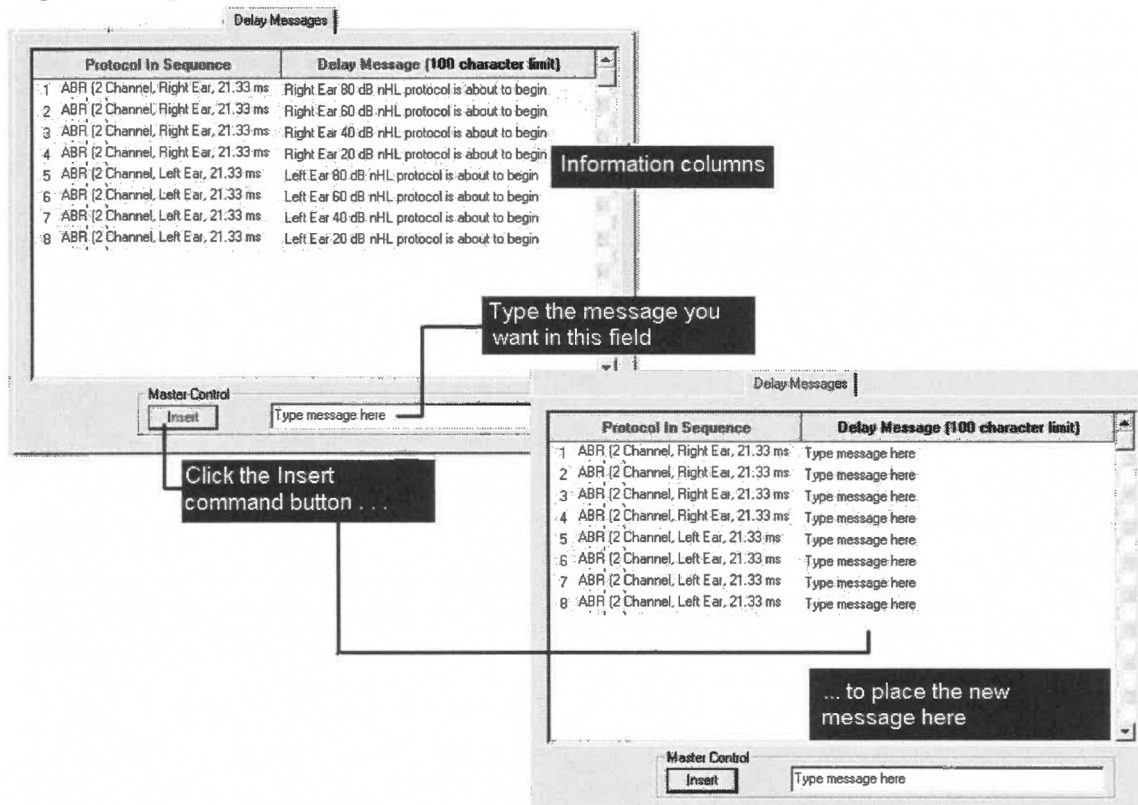
Component	Description	
Protocol List field	Lists all available protocols that can be used in a sequence.	
Sequence of Protocols fields	Displays the protocols selected to be used in the sequence.	
Command Buttons	Use these command buttons with the Protocol List field and the Sequence of Protocols field to choose the protocols you want in the sequence, and to set the order of the protocols in the sequence. These command buttons include:	
	Add	Moves a highlighted protocol from the Protocol List field to the Sequence of Protocols.
	Remove	Removes a highlighted protocol from the Sequence of Protocols.
	Move Up	Moves a highlighted protocol up in collection order in the Sequence of Protocols.
	Move Down	Moves a highlighted protocol down in the collection order in the Sequence of Protocols.

Sequence Actions tab



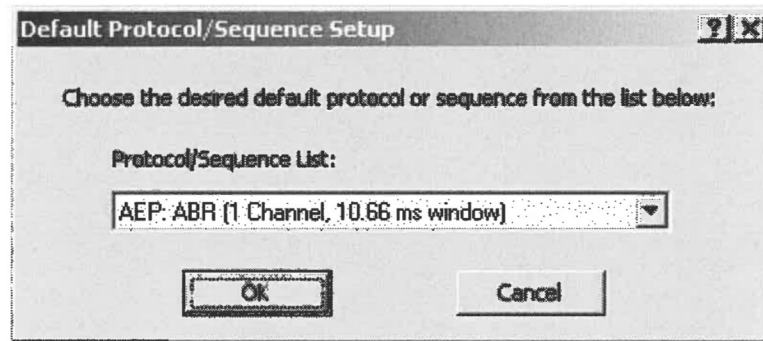
Component	Description	
Protocol In Sequence column	Read-only information column that lists the protocols in the order they will be collected.	
#Reps column	Displays the number of times the protocol is repeated. This can be modified by typing in another number next to the protocol or by using the Master Control area.	
Intensity change/prot. column	Displays the intensity change applied to the protocol. If the protocol default is 80 dB and the intensity change is -20, then the stimulus will be delivered at 60 dB. This can be modified by typing in a number in the field for the desired protocol or by using the Master Control area. Type in a number in decibels relative to the intensity saved in the protocol at which you want the stimulus to be delivered (e.g. 0 means no change from the protocols definition of intensity).	
Delay Time (s) column	Displays the delay time in seconds that will occur before collection with the protocol will begin. This can be modified by typing in a number or by using the Master Control area.	
Master Control Tools	Use these tools to modify the data in the #Reps, Intensity/prot. and Delay Times columns. These tools include:	
	Insert command button	Click this button after changes have been made to the three values in order to implement them into all columns in the window.
	#Reps field	Enter the number of reps you want the application to automatically perform for each protocol in the sequence.
	Intensity change/prot. field	Enter the intensity change you want the application to deliver compared to the value saved in the protocol or use the spin buttons for each protocol in the sequence.
	Delay Time field	Enter a Delay Time or use the spin buttons for each protocol in the sequence.

Delay Messages tab



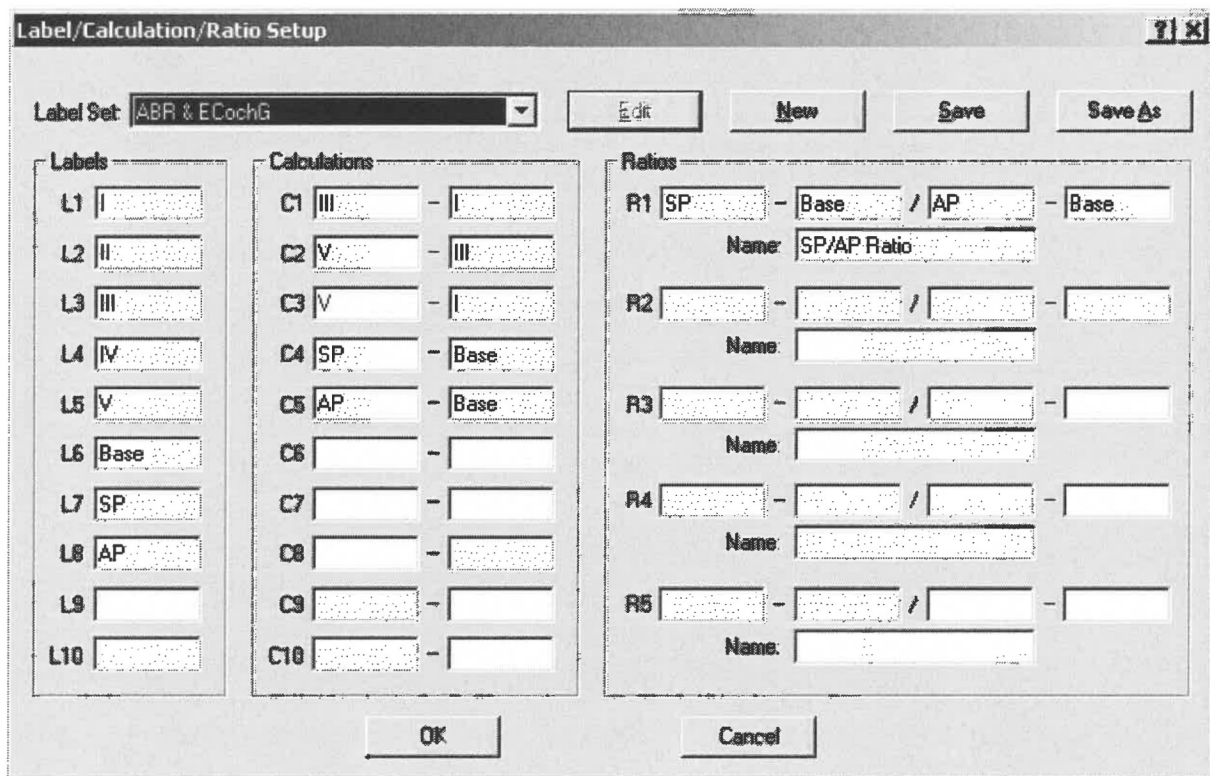
Component	Description
Protocol In Sequence column	Read-only list of the protocols for the current sequence.
Delay Message column	Lists the delay messages that will appear before data collection with each of the protocols will begin during the sequence.
Insert command button	Click this button after changes have been made to the Master Control values in order to enter the same values into all of the corresponding fields above.
Message field	Type in a message you want the application to display during the delay between protocols (100 character limit).
Master Control area	Allows you to quickly insert the same delay message for all protocols in the sequence. Type in the text and select Insert.

Default Protocol/Sequence



The Default Protocol/Sequence Setup item launches the Default Protocol/Sequence Setup dialog box. This dialog box contains a list of default protocols and protocol sequences available to the AEP program. Choose the protocol or sequence in the drop down list that you want to be the default. This protocol or sequence will appear in the protocol window when the software is launched.

Label/Calculation Sets



Edit the labels, calculations, or ratios from this dialog box. Some of the manufacturer-supplied label sets cannot be edited. See Selecting, Checking, and Changing Collection Protocol – Protocol Labels/Calculations tab section.

Transducer Calibration

Transducer Calibration [?] [X]

Entered values set the dB correction factor that will be in effect when the program intensity is set to 0 dB for the chosen calibration reference and transducer.

Bone Oscillator	Broadband Inserts	ER2 Inserts
Insert Earphones	Headphones	
Maximum Linear Output		
Stimulus: 132 dB SPL	Noise: 132 dB SPL	
	SPL	HL
Click	0	35
250 Hz	0	14
500 Hz	0	6
750 Hz	0	2
1000 Hz	0	0
1500 Hz	0	2
2000 Hz	0	3
3000 Hz	0	4
4000 Hz	0	6
6000 Hz	0	2
8000 Hz	0	0
White noise (contra)	0	23
White noise (ipsi)	0	23
Pink noise (ipsi)	0	39

☒ Manufacturer Defaults ☐ Use Defaults

OK Cancel

See Calibration section.

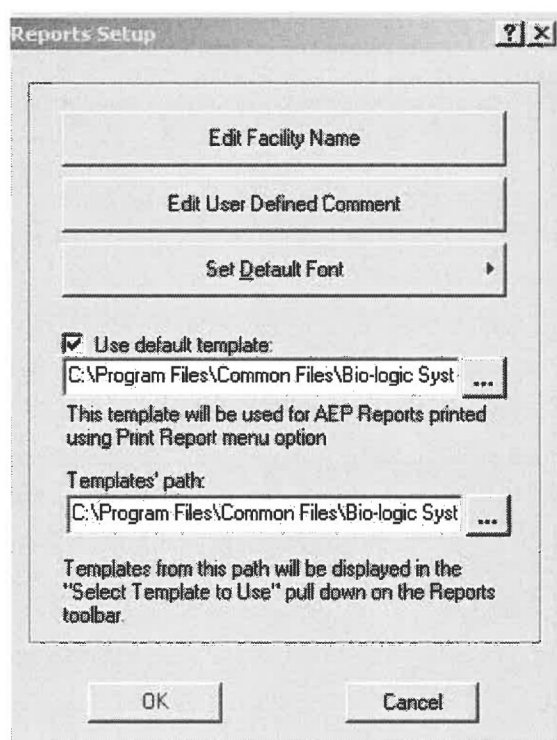
The Transducer Calibration display is a tool that lets you set correction factors for each transducer and stimulus for the various calibration reference settings.

Note: All of the tabs in this tab set function in the same way. Use this illustration as an example to help you operate the Insert Earphones, Headphones, Bone Oscillator, ER2 Inserts, and Broadband Inserts tabs.

Making modifications to the calibration table will alter the stimulus output.

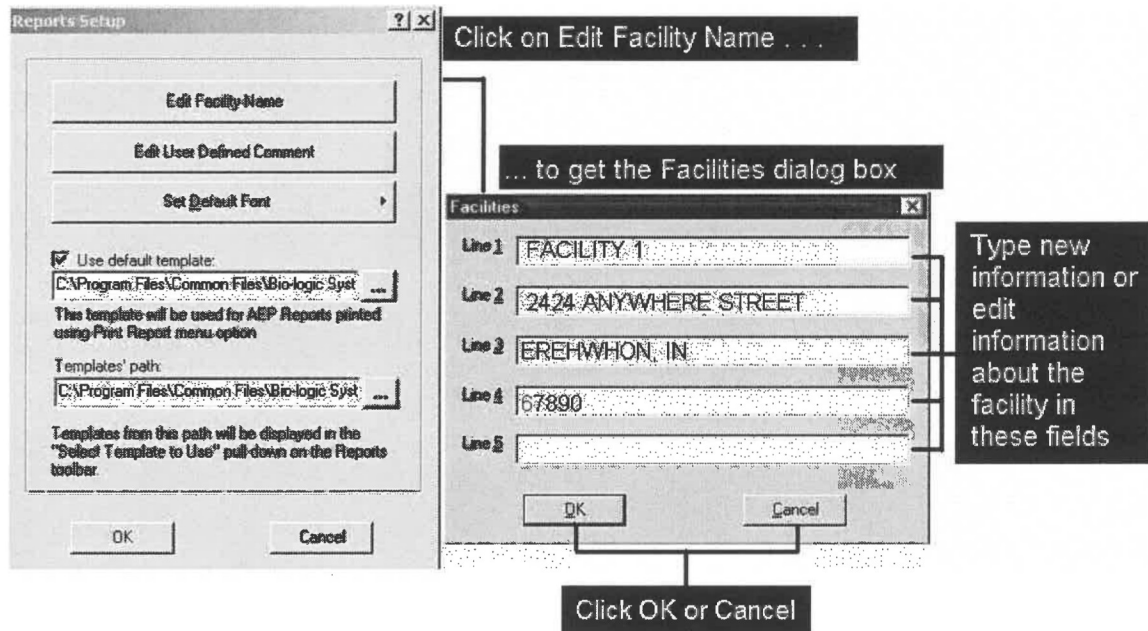
Component	Description
Insert Earphones tab	Click on this tab to make the Insert Earphones Tab active (used for the Bio-logic Inserts and ER3s).
Headphones tab	Click on this tab to make the Headphones (TDH-39) Tab active.
Bone Oscillator tab	Click on this tab to make the Bone Oscillator Tab active.
ER2 Inserts tab	Click on this tab to make the ER2 Insert Tab active.
Broadband Inserts tab	Click on this tab to make the Broadband Inserts Tab active.
Manufacturer Default checkbox	Select this checkbox until a checkmark appears to use Manufacturer's defaults for the SPL, HL, and nHL settings. Click the checkbox until no checkmark appears to deactivate Manufacturer's defaults for the SPL, HL, and nHL settings, allowing the values to be edited.
SPL fields	If SPL is selected for the dB reference in the protocol – Stimulus Tab – these correction values will be used.
HL fields	If HL is selected for the dB reference in the protocol – Stimulus Tab – these correction values will be used.
nHL fields	If nHL is selected for the dB reference in the protocol – Stimulus Tab – these correction values will be used. This is the default for all protocols.
Use Defaults checkbox	Select this checkbox until a checkmark appears to activate defaults for the SPL, HL, and nHL settings. Click the checkbox until no checkmark appears to deactivate defaults for the SPL, HL, and nHL settings.
OK command button	Closes the Transducer Calibration screen and implements any changes you have made.
Cancel command button	Closes the Transducer Calibration screen without implementing any changes.

Report Setup



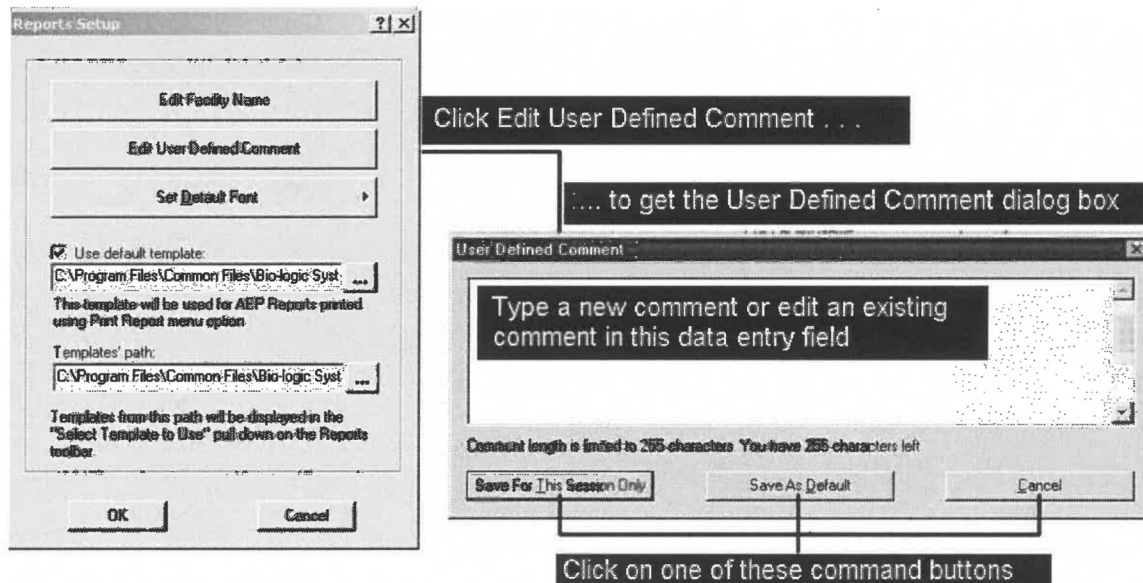
Component	Description
Edit Facility Name command button	Launches a Facility Name dialog box to enter the Facility name. This will print near the top of the report(s).
Edit User Defined Comment command button	Launches a User Defined Comment dialog box to enter a fixed comment. You can add the User Defined Comment field to a report template.
Set Default Font command button	Launches a Set Default Font dialog box.
Use default template checkbox and data entry field and browse button	Select (click on) this checkbox (checkmark appears) to activate the Use default template file data entry field and search button. Select the default report by clicking on the browse button and double clicking on the report template. You should choose the most commonly printed report template.
Template path data entry field and search button	Displays the data path location that the application looks in to find and display the report templates. The default location on software installation is C:\Program Files\Common Files\Bio-logic Systems Corp.

Edit Facility Name



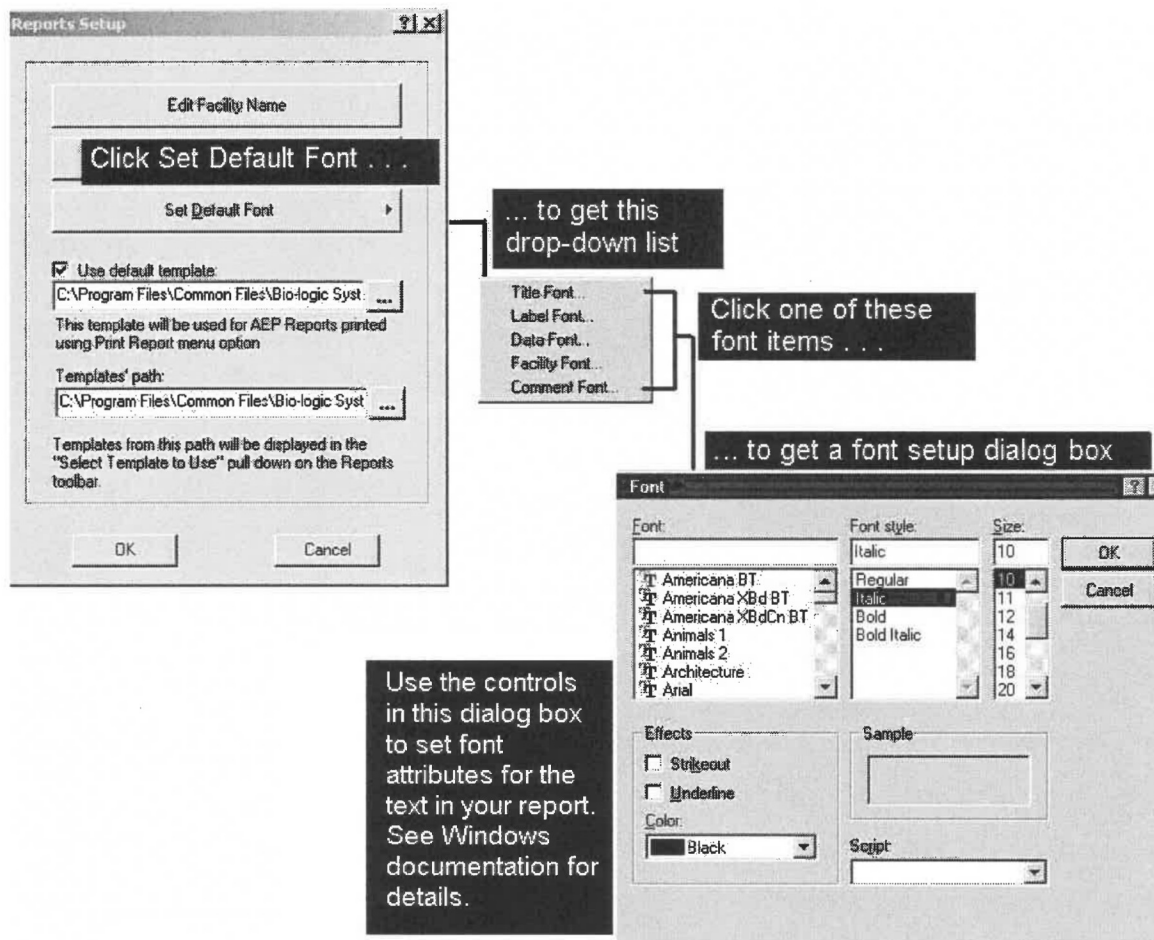
The Edit Facility Name feature lets you add or edit information about your facility. This information prints on every report that is provided by Bio-logic as part of the application installation.

Edit User Defined Comment



The Edit User Defined Comment feature lets you add or edit a fixed comment that can be printed on every report. This field is NOT intended to be a patient-specific comment, but rather, a general comment that you want to appear on every report. For this comment to appear on a report, you must add the User Defined Comment field on the report template.

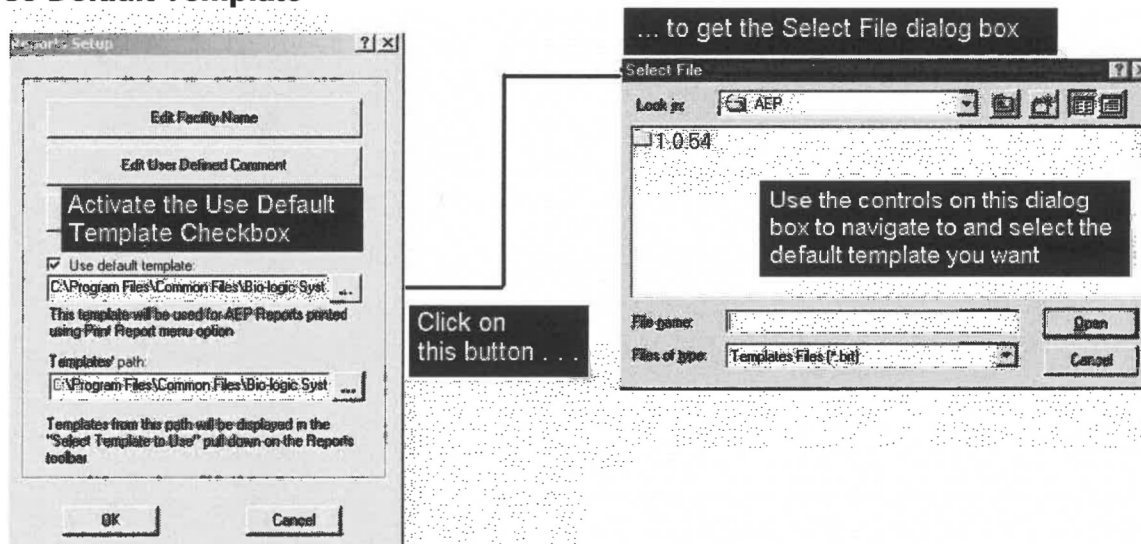
Set Default Font



The Set Default Font feature lets you set font, face (style), size, and color attributes for the various types of text that appear on your report.

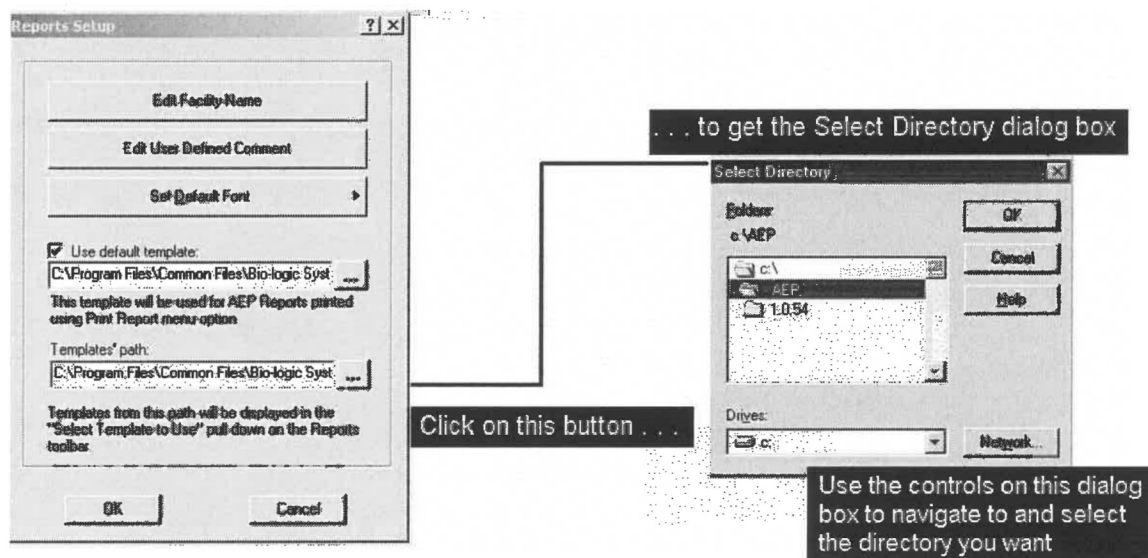
Note: The Microsoft® Corporation has thoroughly documented dialog boxes of this type.

Use Default Template



The Use Default Template feature lets you determine the default report (eg ABR or VEMP) that will be displayed every time that you choose the Print Report menu item.

Templates' Path



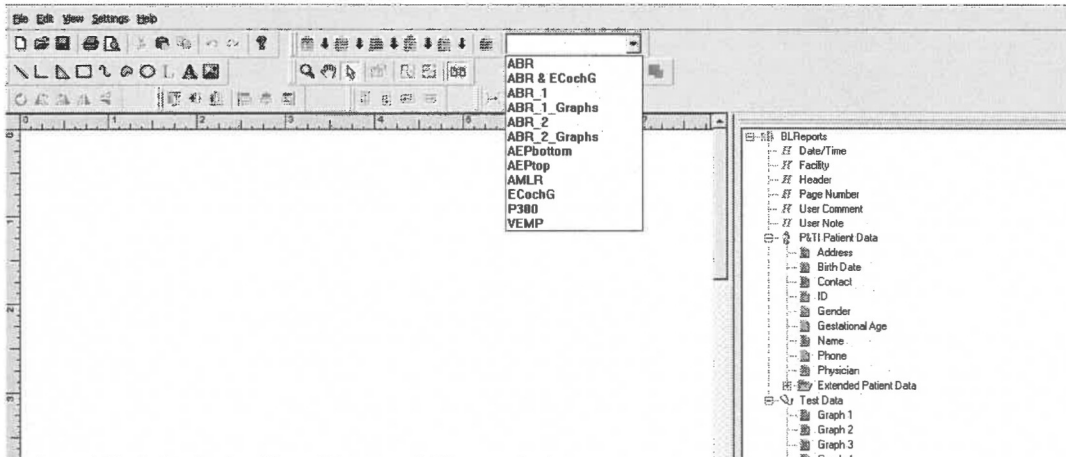
The Templates' Path feature lets you assign a path or a directory that the AEP program uses to save new templates and to access report templates for printing reports.

Note: The Microsoft® Corporation has thoroughly documented dialog boxes of this type.

AEP Report Layout

The Reports Layout item allows you to choose between an AEP, BioMAP, or SABR/CHAMP report type and launches a blank "Report" screen. If you are making many modifications, please contact Bio-logic Hearing Technical Support for assistance.

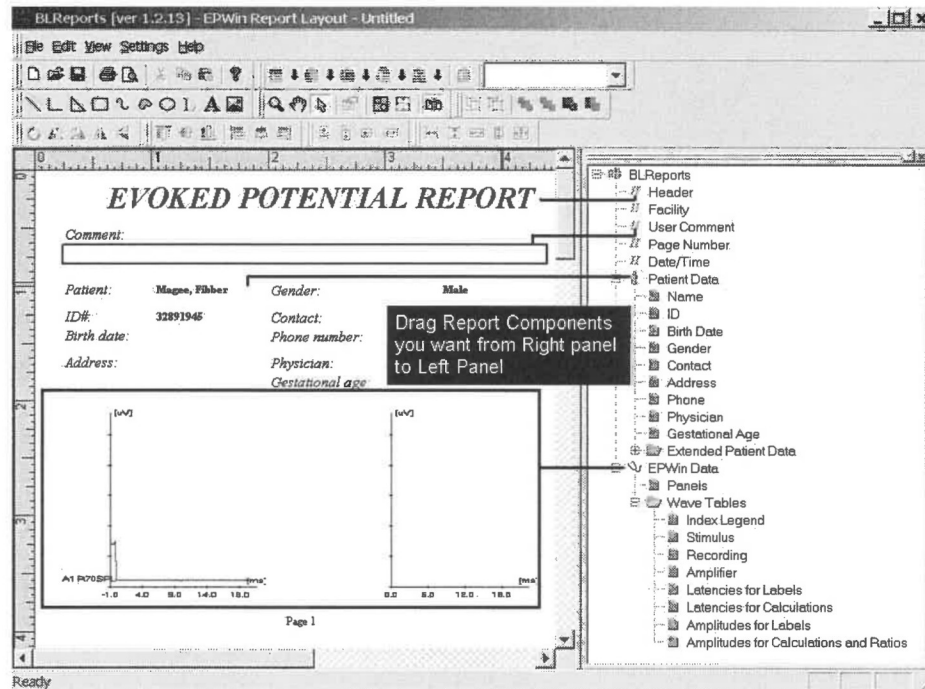
1. Choose the report Template name from the drop down list that is the one you want to edit or use as a basis for creating a new report template.



Moving Fields into the Report Template

The Field Tree appears on the right side of the template. The Field Tree contains components of a report that you might want to print. If this tree is not displayed:

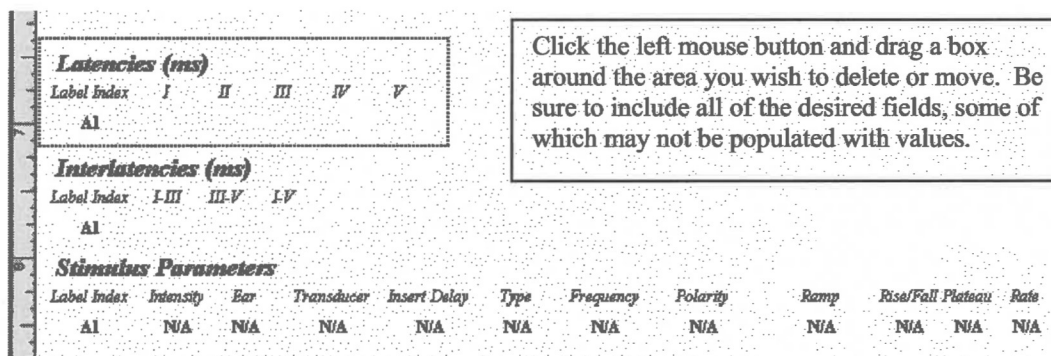
2. Click on View and then Field Tree.
3. Select a desired report component from the field tree and drag it to the desired location on the template. If there is a "+" in the box next to the field option, click on the "+" to display additional report components.



Deleting and Moving Fields on the Template

To select a section:

1. Move the mouse cursor to an area just outside of the section you want to delete or move.
 2. Left click the mouse and drag a box around the entire section you want to delete or move. When you release the mouse button the fields you selected will display surrounded by small boxes around the perimeter.
- If you select a field component that is not wanted, hold down the shift button on the keyboard and click on the unwanted field. In the illustration, notice that the Latencies section is selected.

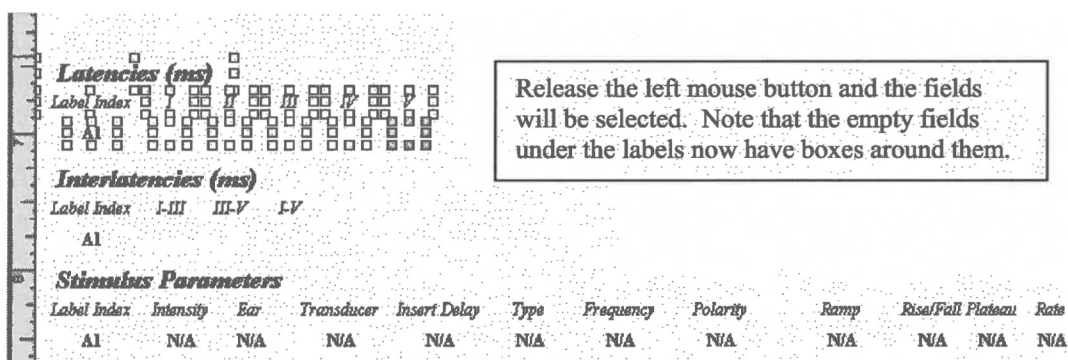


Click the left mouse button and drag a box around the area you wish to delete or move. Be sure to include all of the desired fields, some of which may not be populated with values.

Latencies (ms)												
Label Index	I	II	III	IV	V							
A1												

Interlatencies (ms)												
Label Index	I-III	III-V	I-V									
A1												

Stimulus Parameters											
Label Index	Intensity	Ear	Transducer	Insert Delay	Type	Frequency	Polarity	Ramp	Rise/Fall Plateau	Rate	
A1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A



Release the left mouse button and the fields will be selected. Note that the empty fields under the labels now have boxes around them.

Latencies (ms)												
Label Index	I	II	III	IV	V							
A1												

Interlatencies (ms)												
Label Index	I-III	III-V	I-V									
A1												

Stimulus Parameters											
Label Index	Intensity	Ear	Transducer	Insert Delay	Type	Frequency	Polarity	Ramp	Rise/Fall Plateau	Rate	
A1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3. To delete the selected fields, click the delete key on the keyboard.
4. To move the selected fields as a group:
 - Place the mouse over the section so that it becomes a cross hatch.
 - Click and hold the left mouse button and drag the section to the desired location. Then, release the mouse button.
 - Alternately, you can use the Nudge Up, Nudge Down, Nudge Right and Nudge Left toolbar icons (seen below) to move the section to a new location.



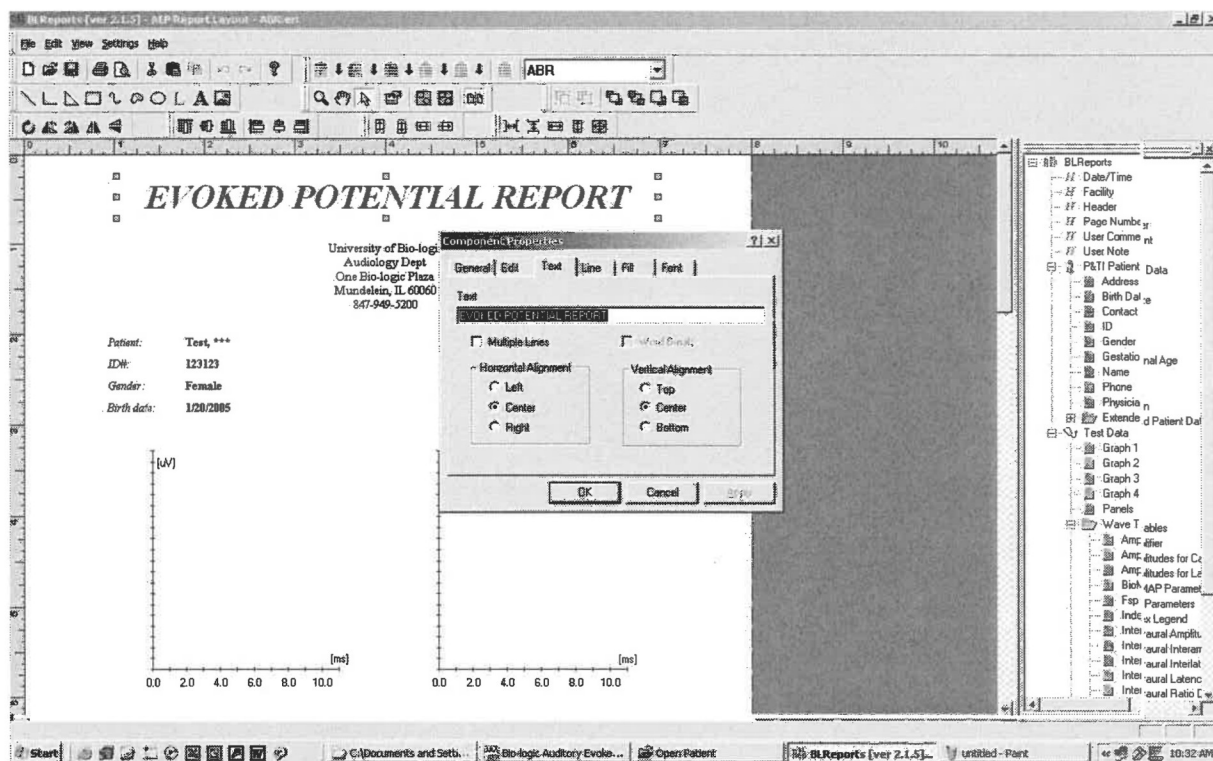
5. To undo any change that you made in error, click on the Undo button



Modifying the text in the Field Labels

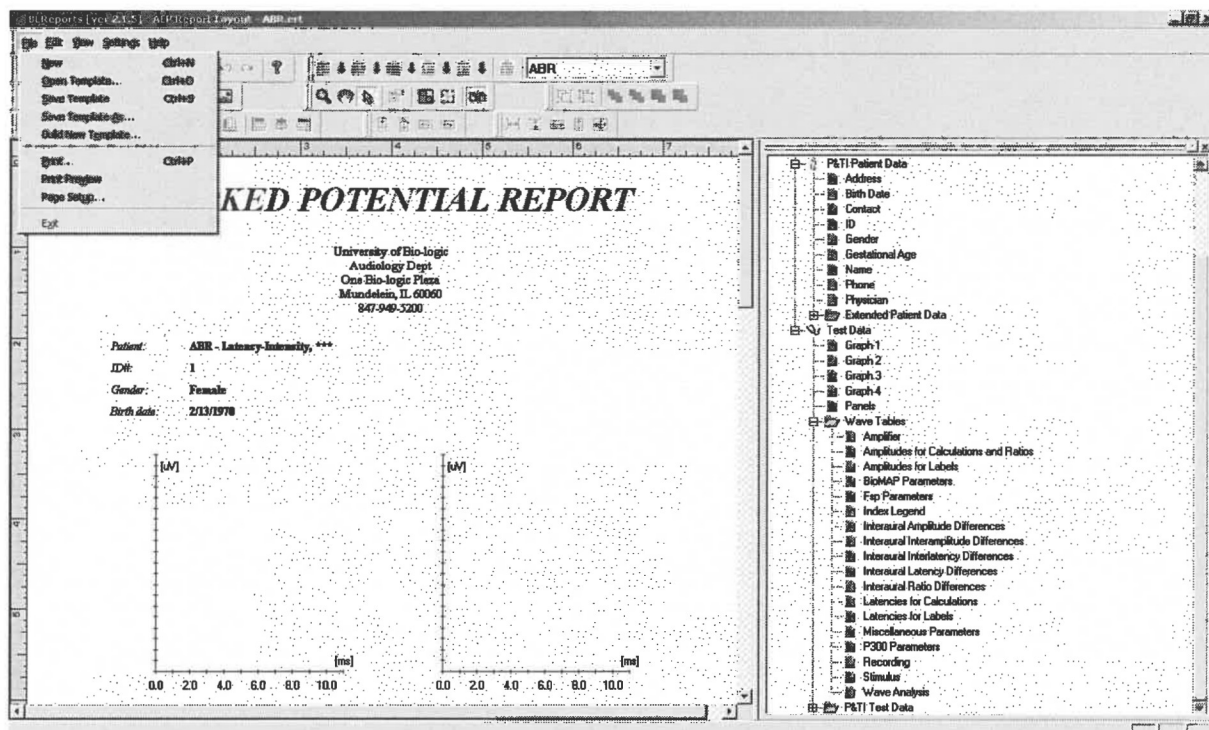
Right click on the Field Label you want to change to display a Component Properties dialog box.

- Click on Text tab to modify the text of the label.
- Click Font tab to modify the font of the text.



Saving Template Changes

1. To Save Changes to an existing template:
—Click File and then Save Template.
2. To Save Changes as a new template name:
—Click File and then Save Template As. Type in a new name.
The new template name must end with the same extension as the AEP templates, “.ert”.
If modifying the Stacked ABR or CHAMP templates described in the next section, the new template name must end with the extension “.srt”.



User Preferences

User Preferences

Frequency Duration Units: ☒ Cycles ☐ Milliseconds

Amplifier Units: ☒ Gain ☐ Sensitivity

Tone Burst Default Duration and Ramp

	Rise/Fall	Plateau	Ramp
250 Hz	0.50	0.00	Blackman
500 Hz	1.50	0.00	Blackman
750 Hz	1.50	0.00	Blackman
1000 Hz	2.00	0.00	Blackman
1500 Hz	3.00	0.00	Blackman
2000 Hz	3.00	0.00	Blackman
3000 Hz	3.00	0.00	Blackman
4000 Hz	4.00	0.00	Blackman
6000 Hz	6.00	0.00	Blackman
8000 Hz	8.00	0.00	Blackman

☒ Open the Open Dialog automatically when the application is started

☒ Prompt Exit

OK Cancel

Component	Description
Frequency Duration Units radio buttons	Select the Frequency Duration Units displayed in the collection protocol setup. Choices include Cycles or Milliseconds. Modifying the rise/fall can only be made in cycles but can be converted and viewed in milliseconds.
Amplifier Units radio buttons	Select the Amplifier Units displayed in the collection protocol setup. Choices include Gain or Sensitivity.

Component	Description	
Tone Burst Default Duration and Ramp	This area of the dialog box contains columns of data entry and data selection fields. These fields let you set default durations for Tone Burst frequencies and select the default Ramp type you prefer.	
	Rise/Fall fields	Sets the default Rise and Fall for each toneburst frequency.
	Plateau fields	Sets the default Plateau for each toneburst frequency.
	Ramp fields	Sets the Ramping you can apply to each toneburst frequency. Choices include: Linear, Hanning, Gaussian, Blackman, Rectangular
Open and Prompt Exit options	Select the checkbox next to the Open item to automatically launch the Open dialog box whenever the AEP application is initialized. Select the checkbox next to the Prompt Exit item to have the message 'Are you sure you wish to exit the AEP application' message appear each time before it closes the AEP application.	
OK command button	Closes the User Preferences dialog box and implements any changes.	
Cancel command button	Closes the User Preferences dialog box without making any changes.	

Export Path

Currently Under Development.

Default Display Parameters

Display Parameters

Waveform Grouping

☒ Match
☐ Align
☐ Superimpose
☐ User Positioning

Alternating Polarity Wave Display *

☒ Alt
☐ Rare & Con
☐ Differential
 * Does not apply to P300 test type

Stimulus Blocking Appearance

☒ Show flat line
☐ Show response

Display Scale

☐ Auto-Specific Scaling
☐ Specific Scale (uV) 0.5
☒ Epoch-Based Scaling

Epoch Range	Display Scale (uV)
5.33 - 32.00	0.5
53.30 - 213.30	40.0
319.80 - 1066.00	10.0

Automatic Collecting Wave Display

Panel Selection

☒ Ear-Panel Same
☐ Ear-Panel Opposite
☐ All-Right Panel
☐ All-Left Panel

AEP, VEMP & P300

☐ Off
☐ Channel 1
☐ Channel 2
☒ Ipsilateral
☐ Contralateral
☐ Both

P300

☐ Off
☐ Infrequent
☐ Frequent
☒ Both

SABR/CHAMP

☐ Off
☒ On

☐ Latency Grid
☐ Waveform Baseline

OK Cancel

Clicking on the Display Parameters item launches the Display Parameters dialog box. This dialog box shows current settings for the Waveform Display Panels and allows you to configure (set up) the display to meet your needs.

Component	Description
Waveform Grouping radio buttons	Select (click on) one of these radio buttons to determine how the AEP program groups waveforms on the waveform panels. Options include: —Match: Matches all displayed waveforms by intensity and leaves a small space between waveforms. —Align: Aligns all displayed waveforms so they are equally separated. —Superimpose: Matches all displayed waveforms by intensity and superimposes their baselines. —User Positioning: Retains user positioning of waveforms. If you want the waveforms to stay where you have moved them you must have User Positioning selected. Note that these radio buttons are exclusive. Selecting one automatically disables the others.

Component	Description	
Alternating Polarity Wave Display checkboxes	Select (click on) these checkboxes and the program automatically shows or hides waveforms when collecting or reviewing data collected with alternating polarity. See Alt Polarity Wave Display section. Choices include: Alt Rare & Con Differential	
Stimulus Blocking Appearance	Show Flat Line - flat lines the beginning of the epoch that is being blocked. Show Response - displays the stimulus artifact in the epoch that is being blocked.	
Panel Selection	Ear Panel Same	Displays the Left waveforms in Panel A and the Right waveforms in Panel B.
	Ear Panel Opposite	Displays the Left waveforms in Panel B and the Right waveforms in Panel A.
	All Right Panel	Displays all waveforms on Panel B.
	All Left Panel	Displays all waveforms on Panel A.
Display scale area	This area of the Display Parameters dialog box contains three radio buttons and related data entry fields.	
	Auto Specific Scaling radio button	The application automatically uses the largest waveform on the panel as a basis for scaling all other waveforms to the same specific display scale.
	Specific Scale (uV) radio button	Scales all waveforms to a defined scale.
	Specific Scale (uV) data entry field and spin button	Type the specific scale (in micro volts per division) that you want to use in this data entry field. You may also use the spin buttons to increase (up arrow) or decrease (down arrow) the value in the field to the value that you want.
	Epoch based Scaling radio button	Sets a specific scale based on the epoch (window) size.
	Epoch Range Display Scale data entry fields and spin buttons	Type the epoch-based display scale for each epoch range in its related field (in micro volts).
	Note: These radio buttons are exclusive. Selecting one automatically disables the others.	

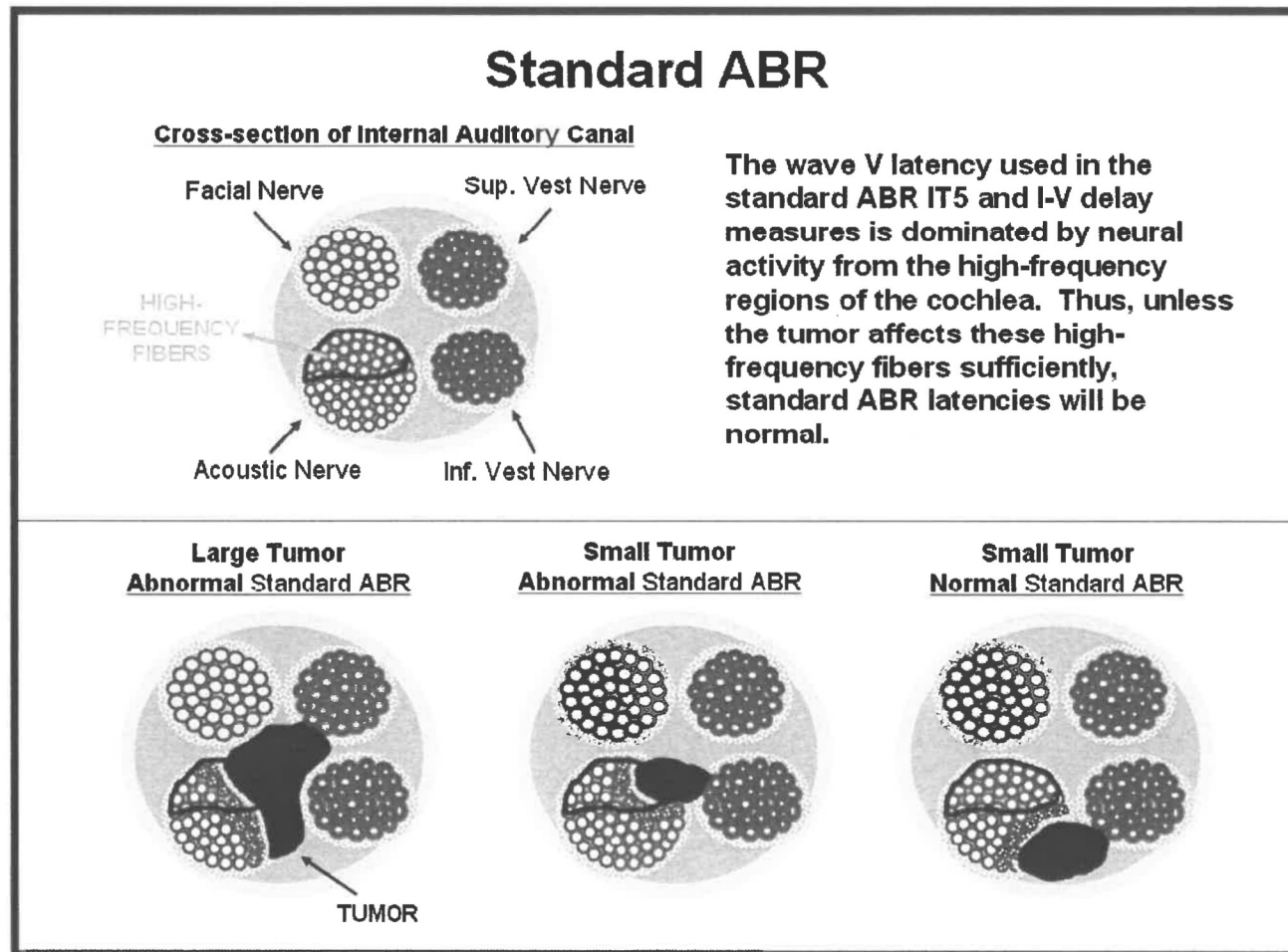
Component	Description	
Automatic Waveform display radio buttons	This area of the Display Parameters dialog box contains three sets of radio buttons.	
Important Note: for the automatic display of ipsilateral and/or contralateral collecting waveforms, the application uses information regarding the stimulated ear in the Stimulus Tab and the Channel Input 1 and Input 2 electrode position identifiers entered in the Amplifier Tab of the Collection Parameters setup dialog. If these are not correctly defined in relation to the way the electrodes are plugged into the patient cable, then the application may display unexpected waveforms on the panels.	AEP, VEMP & P300 radio buttons	Select (click on) one of these radio buttons to define which channel(s) of data for AEP data types automatically display during data collection. Choices include: —Off: No AEP data appears on the display automatically. —Channel 1: Channel 1 data appears on the display automatically. —Channel 2: Channel 2 data appears on the display automatically. —Ipsilateral: Ipsilateral data appears on the display automatically. —Contralateral: Contralateral data appears on the display automatically. —Both: Contralateral and Ipsilateral or both channels of data appear on the display automatically. Note that these radio buttons are exclusive. Selecting one automatically disables the others.
	P300 radio buttons	Select (click on) one of these radio buttons to define which buffers of P300 data automatically display during data collection. Choices include: —Off: No P300 data appears on the display. —Infrequent: Infrequent P300 data appears on the display automatically. —Frequent: Frequent P300 data appears on the display automatically. —Both: Frequent and Infrequent P300 data appears on the display automatically. Note that these radio buttons are exclusive. Selecting one automatically disables the others. Also be aware that you must select the desired channel in the AEP&P300 section for P300 waves to appear automatically during data collection.
	Stacked ABR radio buttons	Select (click on) one of these radio buttons to activate or deactivate the automatic display of collecting Stacked ABR/CHAMP waveforms on the panel during data collection.
Latency Grid checkbox	Select the checkbox next to the Latency Grid item to show or hide a latency grid on the waveform panels.	
Waveform Baseline checkbox	Select the checkbox next to the Waveform Baseline item to show or hide a waveform baseline.	

GraphMaster

See GraphMaster Normative Data and Setup section.

Stacked ABR Technology Tutorial

This section presents a review of Stacked ABR technology and compares it to standard ABR techniques.



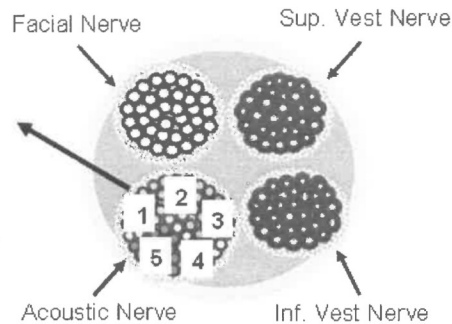
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Stacked ABR

Activity from area 1 **1**
 +
 Activity from area 2 **2**
 +
 Activity from area 3 **3**
 +
 Activity from area 4 **4**
 +
 Activity from area 5 **5**

Total Neural Response
 = Sum of Activity from
 five frequency regions

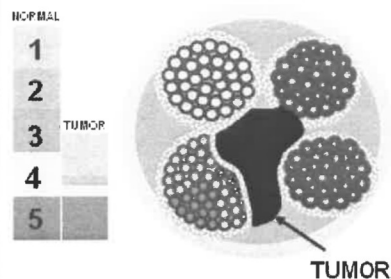
Cross-section of the Internal Auditory Canal



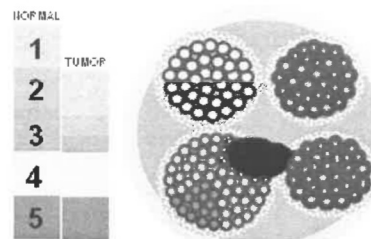
Required for Successful Detection of Small Acoustic Tumors

- An auditory signal that will stimulate essentially all frequency regions of the cochlea (i.e., an appropriate click)
- A method for separating out responses from the different frequency regions of the cochlea (i.e., derived-band ABR technique)
- A procedure of adding the responses together to approximate total neural activity (i.e., stacking method)

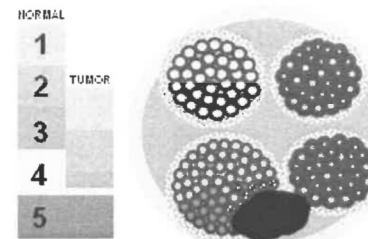
Large Tumor Abnormal Stacked ABR



Small Tumor Abnormal Stacked ABR



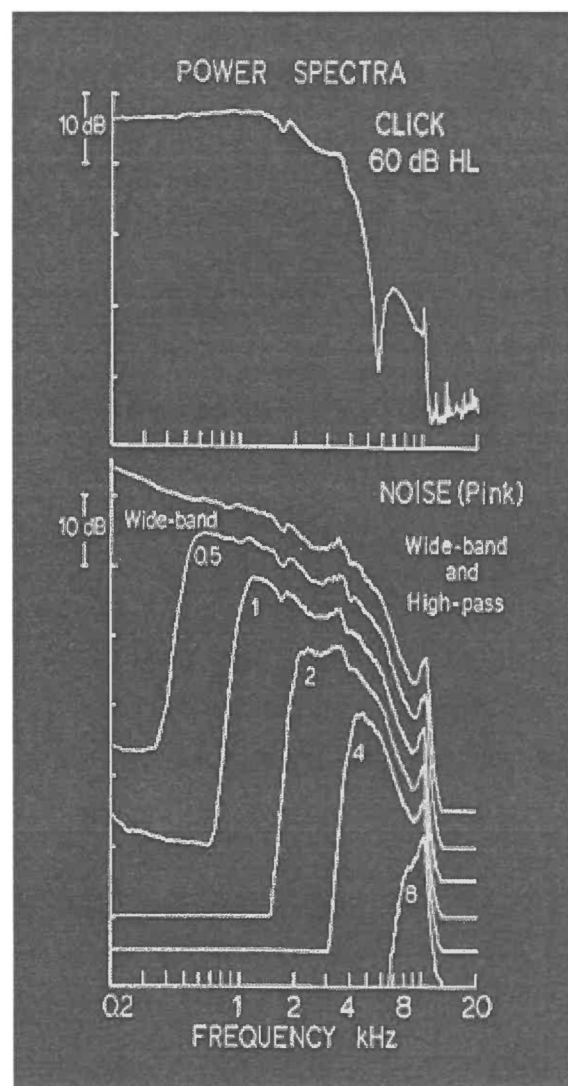
Small Tumor Abnormal Stacked ABR



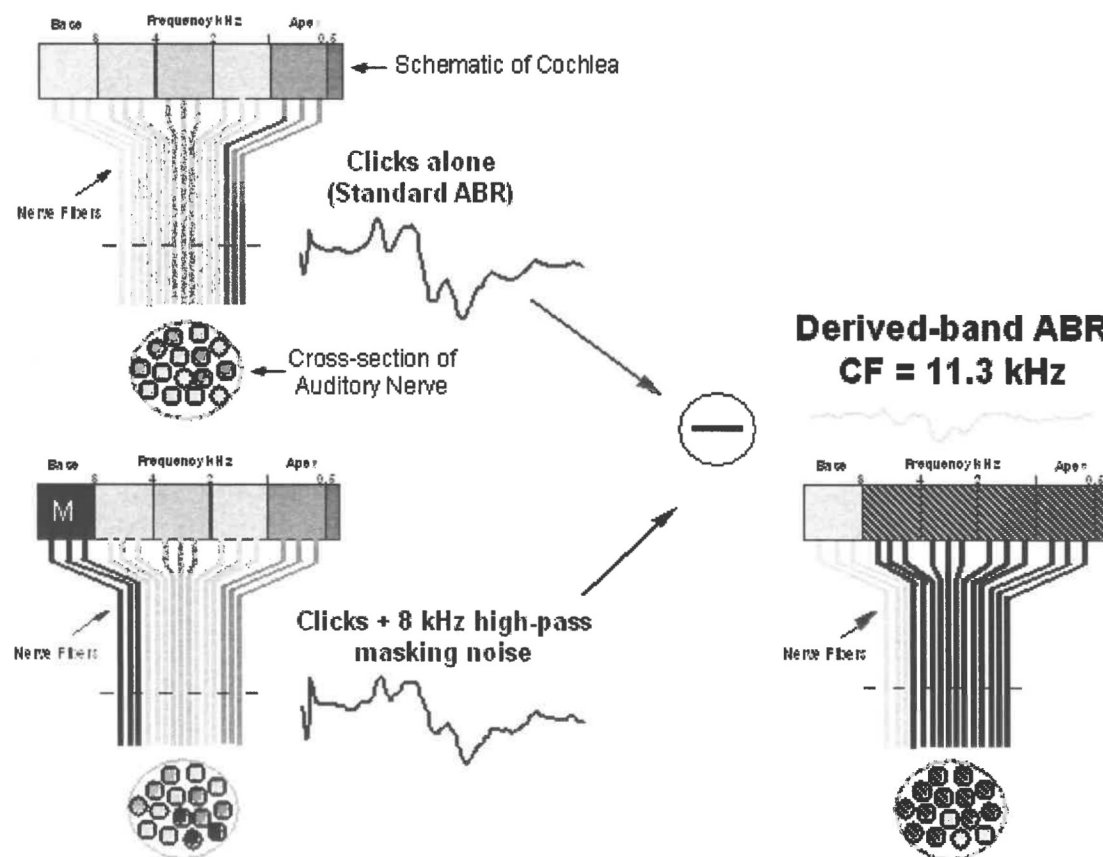
Standard ABR missed this tumor!

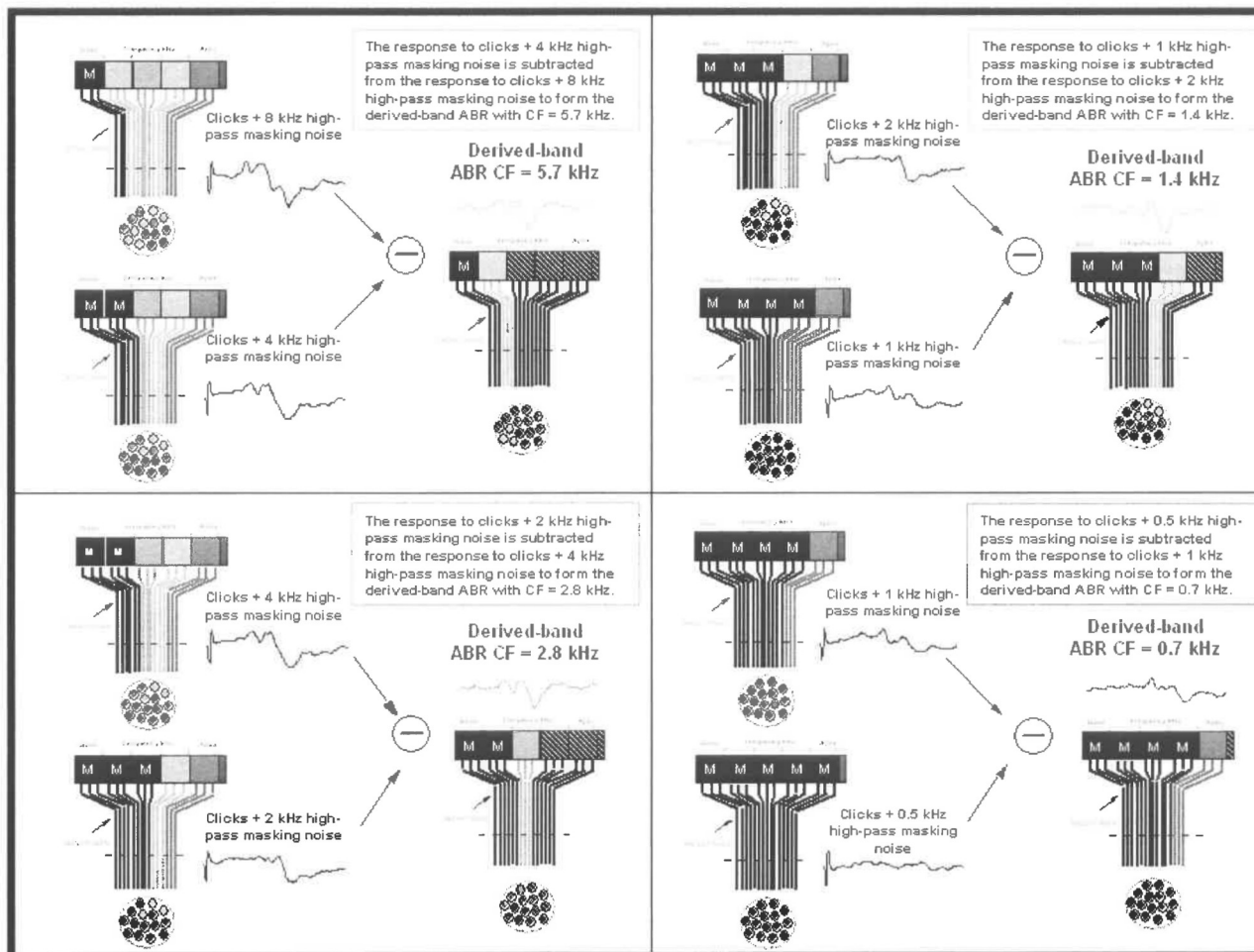
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The Derived-band Technique



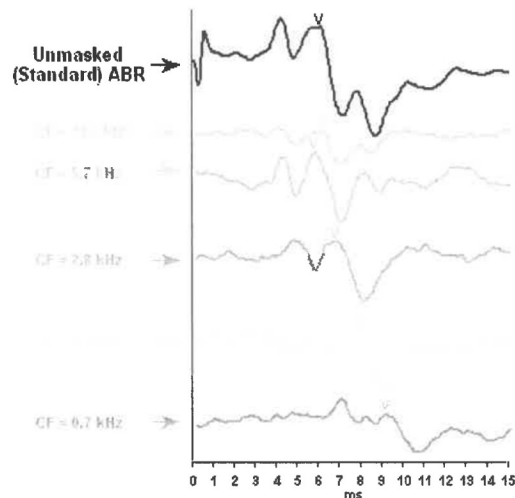
Click stimuli are delivered in the presence of high-pass masking noise. The cutoff frequency of the high-pass noise is lowered from one run to the next. This process masks progressively lower frequency areas of the cochlea. Subtracting the response for one run from the previous one forms a derived-band response. Here, the response to clicks + 8 kHz high-pass masking noise is subtracted from the response to clicks alone to form the derived-band ABR with center frequency (CF) = 11.3 kHz.





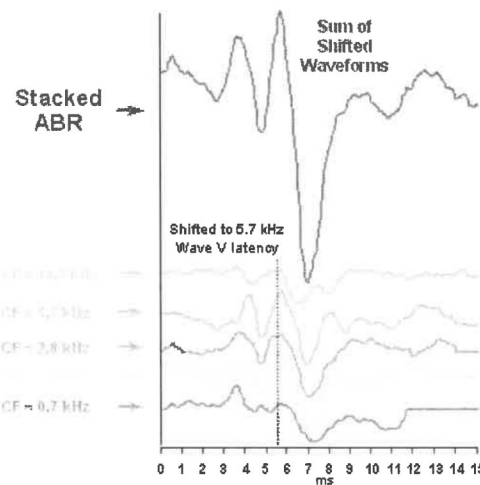
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The Stacking Method



Derived-band ABR Summary

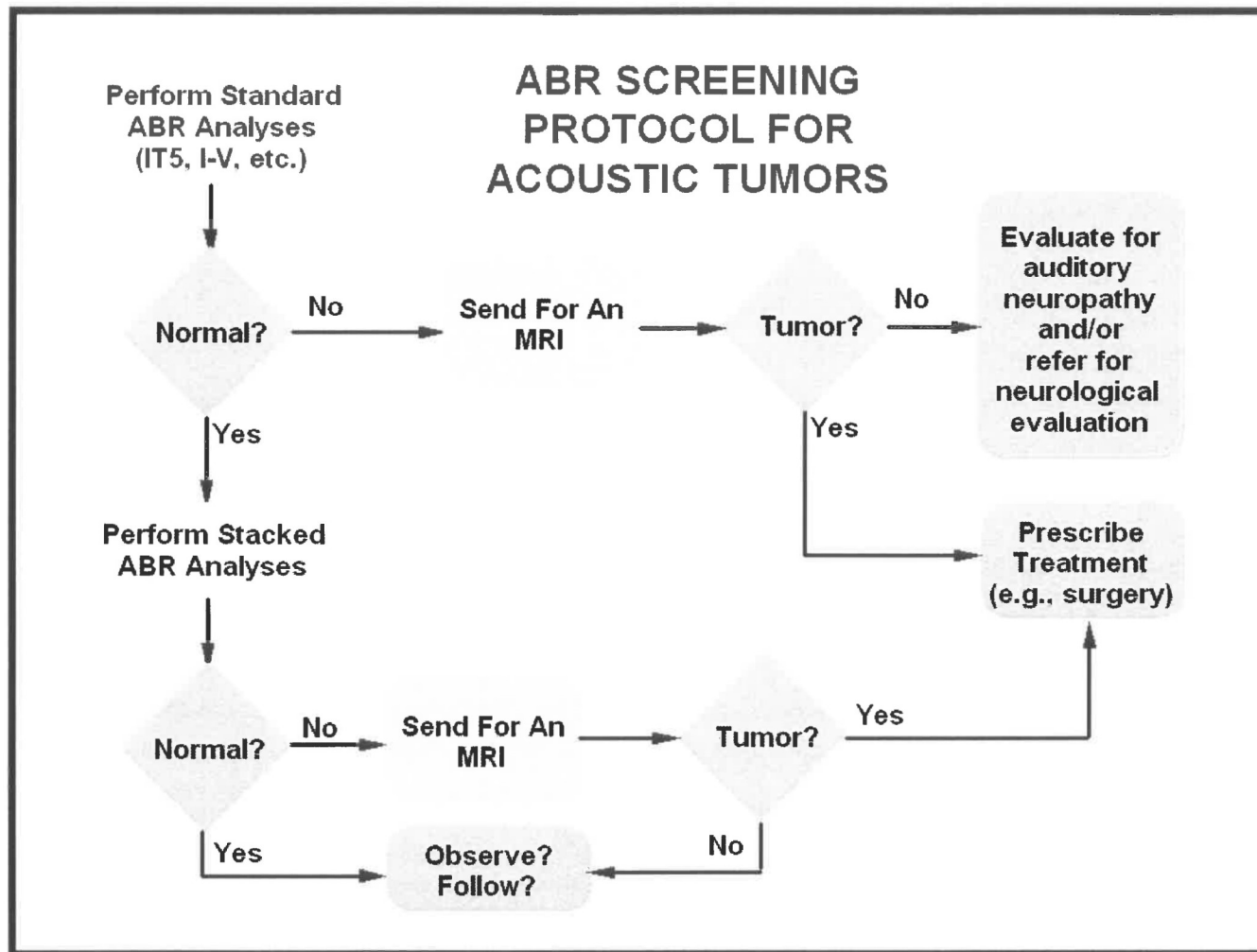
- Neural contributions from different frequency regions of the cochlea can be obtained using the derived-band ABR method.
- Derived-band ABRs represent activity from more specific frequency regions than moderate-to-high level toneburst-evoked ABRs.



Stacked ABR Summary

- The Stacked ABR is formed by temporally aligning wave V of the derived-band ABRs and then summing the responses.
- Aligning the derived-band ABRs eliminates phase cancellation of lower frequency activity. Thus, the Stacked ABR amplitude reflects activity from all frequency regions of the cochlea, not just the high frequencies.
- Reduction of any neural activity due to a tumor, even a small tumor, will result in a reduction of the Stacked ABR amplitude.

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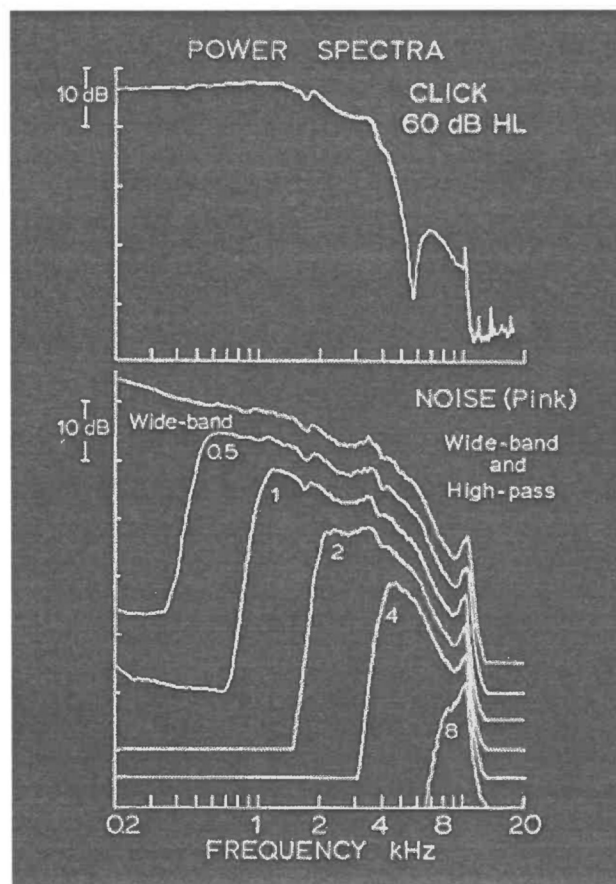


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CHAMP Technology Tutorial

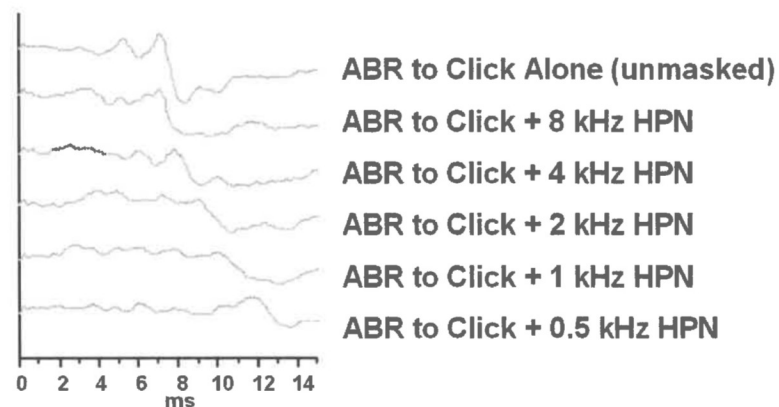
This section presents a review of CHAMP technology.

Obtaining the High Pass Responses



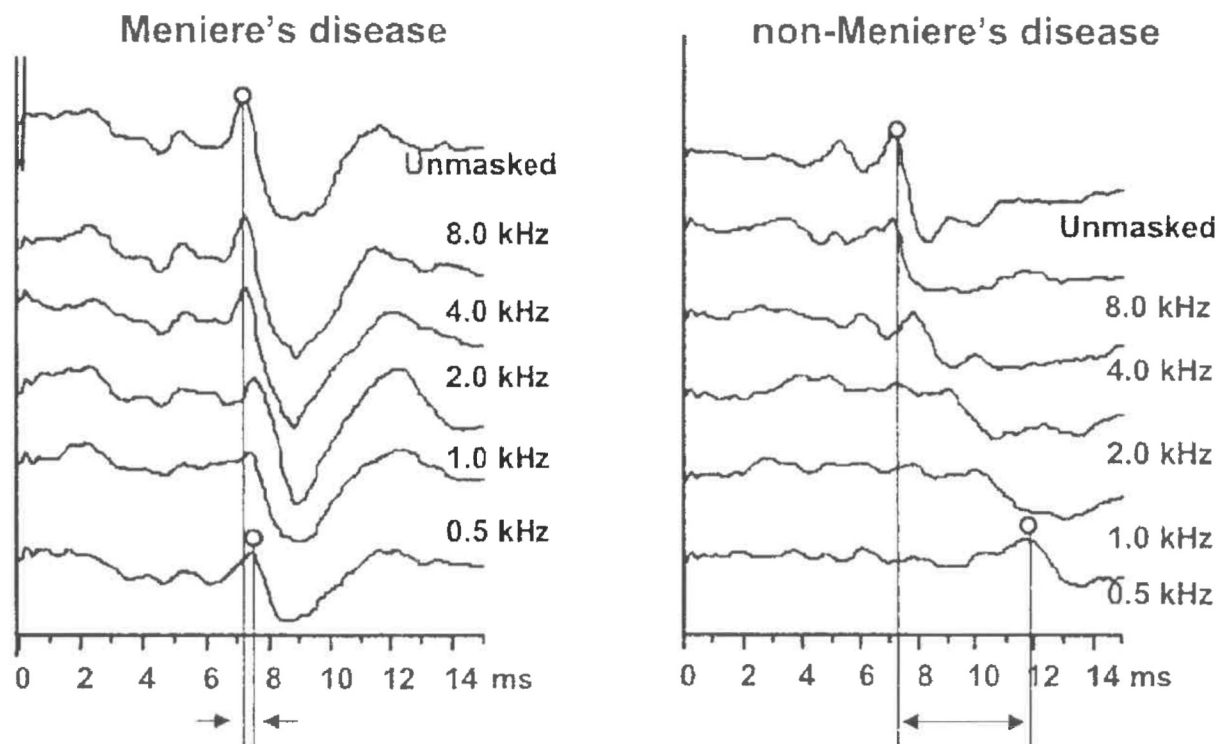
Click stimuli are delivered in the presence of high-pass masking noise. The cutoff frequency of the high-pass is lowered from one run to the next. The click and masking noise are presented ipsilaterally.

Click Alone (Unmasked) and High Pass Noise (HPN) Responses



Note that in this normal hearing, non-pathologic ear, as more high pass masking noise is added, the peak of activity in each response moves out in time because of the traveling wave delay down the cochlea.

Wave V Latency Delay (500 Hz HP – Click Alone)

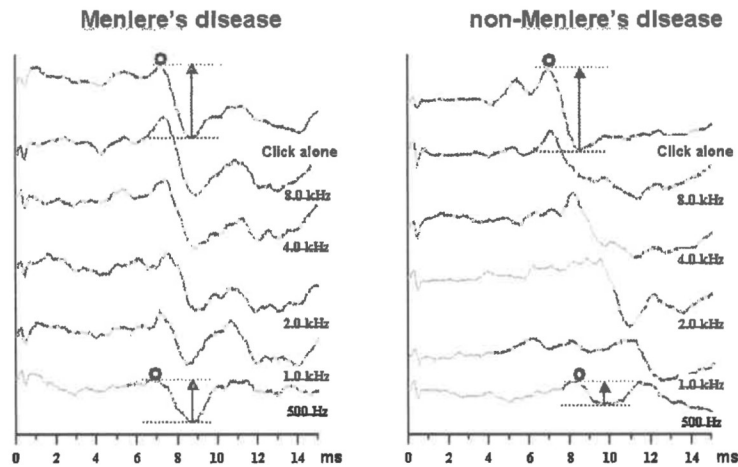


The first analysis is the Wave V latency delay that is obtained by taking the Wave V latency of the click plus 500 Hz high pass masking and subtracting the Wave V latency of the click alone response. The Wave V latency delay is clearly shorter in the Meniere's ear.

Data provided by the House Ear Institute, Dr. Manual Don.

CHAMP looks at both latency and amplitude. The software automatically calculates a “Simple Amplitude” Ratio. This ratio is the amplitude of Wave V of the click plus 500 Hz high pass masking divided by the amplitude of Wave V of the click alone. Notice that in the Meniere’s ear, the amplitude is similar for all responses.

Simple Amplitude Ratio: 500 Hz HP/Click alone



When do you need to do further analysis of the data

IF the latency delay is ≤ 0.45 ms

and

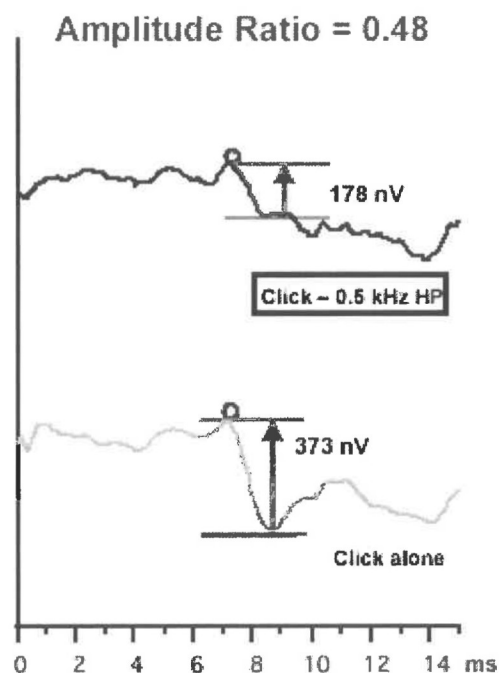
the simple amplitude ratio is ≤ 0.45 ,

THEN the ratio x delay analysis is recommended!

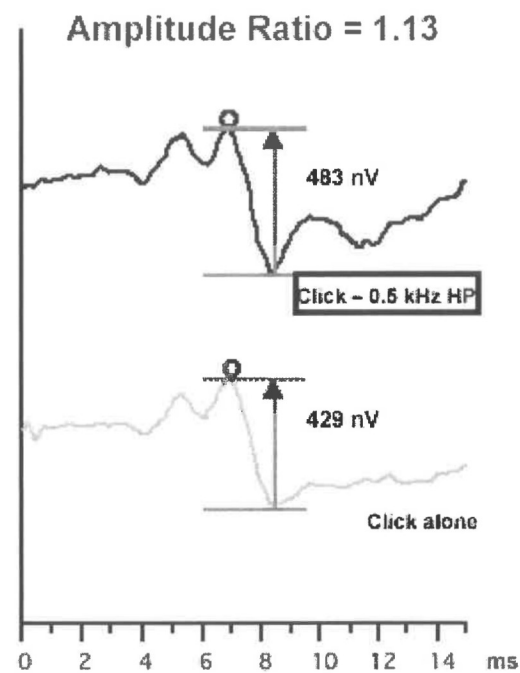
The software automatically performs the required calculations and the recommendation is displayed in the results window if the criteria are met.

Complex Amplitude Ratio Measure

Meniere's Disease Side



Non - Meniere's Disease Side



The second analysis is the "complex amplitude ratio." This ratio is obtained by dividing the amplitude of wave V of the subtracted response (click alone - 0.5 kHz high-pass) by the amplitude of wave V of the click alone response.

Don et al. An Alternative Diagnostic Test for Meniere's and Cochlear Hydrops Using High-Pass Noise Masked Responses: The Complex Amplitude Ratio. Audiology and Neuro-Otology (Submitted 2006)

Stacked ABR & CHAMP Data Collection (Exactly the Same for Both Tests)

Patient and Equipment Prep (to be completed before beginning test session)

Patient Prep

1. Verify that the patient does not meet any of the exclusion criteria:

The Stacked ABR test may provide useful diagnostic information for patients with an auditory system abnormality. However, users should not perform the test when any of these conditions exist:

- Conductive or mixed hearing loss
- Flat sensorineural hearing loss of 60 dB HL or greater.
- Residual hearing at only 250-750 Hz.
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.
- Hyperacusis.

The CHAMP test may provide useful diagnostic information for patients with cochlear hydrops. However, users should not perform the test when any of these conditions exist:

- Conductive or mixed hearing loss.
- Flat sensorineural hearing loss of 70 dB HL or greater.
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.
- Hyperacusis.

2. Supplies Needed:

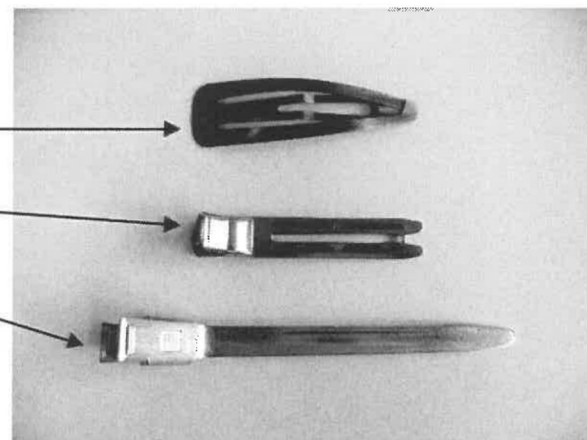
1. tape measure
2. marking pencil
3. cotton balls
4. hair clips:

ballerina

pin curl

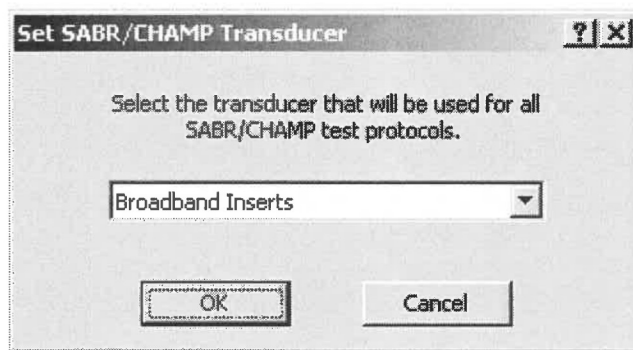
straight

5. gauze pads
6. skin prep gel
7. electrode paste
8. electrodes – **you must use non-disposable electrodes**



Equipment Setup

1. Make sure the **Bio-logic Broadband or ER2** (not the *Bio-logic Inserts or ER3*) earphones are plugged into the NavPro (DSP) box.
2. Enter patient information. It **must** include: Gender, Audiogram, and Birthdate.
See Opening a Patient File section & Audiogram section. **The audiogram should be recent. Do not assume that because immittance measures are normal that an air/bone gap does not exist. Perform bone conduction audiometry to verify that a conductive or mixed hearing loss is not present.**
3. Verify that the software is using the correct transducer. If the correct transducer is not set, your stimuli output will not be accurate. The transducer set will be the default for all Stacked ABR and CHAMP protocols. During data collection, verify that the correct transducer is selected by checking the field tree. See Understanding the Stacked ABR/CHAMP field tree section.
 - a. Click on Hardware Setup
 - b. Click on Set SABR/CHAMP transducer
 - c. Select the transducer you are using, either Broadband Inserts or ER2 Inserts



USE THE CORRECT EARPHONES!

ER3 & Bio-logic Inserts for AEP
ER2 & Bio-logic Broadband for Stacked
ABR & CHAMP

2. Perform a Listening Check – See Performing a Listening Check section.

Test Session

INTRO TO SESSION

Before you begin, inform the patient what you are going to do:

Briefly describe session:

Prep - 3 recording electrodes → measure & mark, clean with prep gel, place using water-soluble paste

During test → sit in recliner or lie on a table/cot, hear clicks and hissing noise, no need to respond, just relax and/or sleep, testing will go faster if you sleep

Note: If you are going to perform the clinical ABR with Bio-logic Inserts or ER3 earphones first, then tell the patient that you may be switching earphones at some point during the test session. **Remember, you only have to do the Stacked ABR if the Standard ABR measures are normal!**

ELECTRODES

Stacked ABR/CHAMP uses one amplifier channel and ground. You must always use these 3 sites, Cz, right mastoid and left mastoid, in order to assure reliable comparisons of your patient's Stacked ABR/CHAMP results with the normative data.

Only use non-disposable electrodes of the same metal type (i.e. silver, silver chloride, or gold). See Electrode Connections for Bio-logic AEP Systems section

Part the hair and use hair bands or clips to secure hair away from the general area of the electrode sites. If the patient is wearing a wig, remove it for proper placement of the electrodes. Use a tape measure and a china marker pencil to mark a line on the top of the head that is 50% of the distance between the nasion (bridge of the nose) and the inion (prominent bump just above the base of the skull). Also mark a line on the top of the head that is 50% of the distance between the preauricular points (indentation just above the tragus). The target site for the Cz electrode is the point at which these two lines intersect. Reposition the hair clips as necessary to assure that the target site remains visible as you continue to apply the electrodes. Mark sites on both mastoids that are equidistant from the Cz electrode site. Select the boniest portion of the mastoid to reduce post auricular muscle artifact (PAM).

Once the electrodes are in place, remeasure the distance between Cz and the two mastoid positions to verify that they are still equal and adjust if necessary. Even small differences can cause interaural amplitude differences in the Stacked ABR/CHAMP that can be interpreted as suspicious, so precise, symmetrical positioning of the electrodes is critical for Stacked ABR/CHAMP.

After electrodes are applied, give the patient a final chance to use the restroom.

TEST SESSION

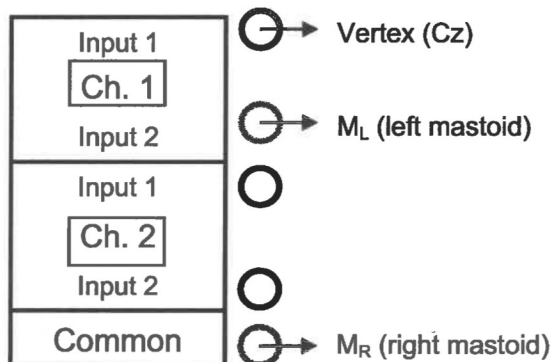
- Reinstruct patient - Test Instructions

When you are ready to begin the test procedure, instruct the patient as follows:

"During the test you will hear a variety of clicks and hissing noises. The sounds will be fairly loud because I want to be sure to get a good response from as much of the hearing nerve as possible, but they are not loud enough to cause any hearing damage. There is no need to respond. It would be best if you can relax deeply with your eyes closed and your jaw loose so that your teeth are slightly separated. The more relaxed you are, the faster the test will be completed. If you fall asleep during the test, this would be the ideal situation. If you need to move, the best time is when there is no sound because the program is not collecting data at those times."

PREP FOR STACKED ABR/CHAMP DATA COLLECTION

- Make patient comfortable (blanket, pillow, remove shoes, etc.)
- Put feet up and push recliner back (make sure feet aren't higher than head)
- Electrodes:
 1. Check electrodes (press on them), then tape leads to chair.
 2. Remove any jumper cables, then connect electrode leads as follows.



- Check impedance
 1. Click on Impedance button .
 2. Make sure impedance is ≤ 5 kOhms for each electrode and the difference between the measurements is ≤ 2 kOhms.
- Instruct patient (keep head straight, relax and/or sleep, move only when no sound, keep eyes closed, etc.).
- Proper placement of earphones, then tape earphone cable to blanket.
 1. Make sure outer edge of foam on eartip is flush with outer edge of ear canal.
 2. Clip transducer to blanket (do not allow transducer to sit on patient's skin).
- Double-check everything.
- Turn off light and close the booth door(s).

NOTE: Preparing the patient for data collection is extremely important. If you rush and/or ignore any of the steps in this section, you may end up with useless data. If you spend a little time here, you will maximize your chances of collecting good data and the test session will run more smoothly and quickly. Review the PAM section for helpful hints on how to minimize muscle artifact by making sure the patient is as relaxed and comfortable as possible.

ER3 = Bio-logic Inserts
ER2 = Bio-logic Broadband

- Recheck impedance before starting test session.
- Give subject a moment to relax.
- Choose AEP protocol for Standard ABR or Sequenced protocol for Stacked ABR & CHAMP to run.
 1. Select a protocol (test suspected ear first!) **and make sure the correct insert phones are connected to the NavPro (DSP) box.**
 - a. To run the clinical ABR, **use Bio-logic Insert phones or ER3s.**
 - b. Remember if the Standard ABR is abnormal – Do NOT perform the Stacked ABR.
 - c. To run the Stacked ABR or CHAMP, **use Bio-logic Broadband phones or ER2s,** and choose either, “SEQ: RE Stacked ABR” to run right ear or “SEQ: LE Stacked ABR” to run left ear sequence. **You must collect all 6 protocols for both Stacked ABR and CHAMP.**
 - d. NOTE: Stacked ABR/CHAMP protocols cannot be modified. These protocols have been optimized for obtaining Stacked ABR and CHAMP data. Any modifications to these protocols would result in the inability to utilize the normative data.
- Run Protocol (See Collecting Data section).
 1. Click on Record button  to start.
 2. If any run in the sequence has too much noise (>20 nV) or Post Auricular Muscle artifact (PAM), repeat that protocol alone.
For example, if subject was quiet for all but the 8.0 kHz high pass condition in the right ear, then load protocol “SABR: RE Stacked ABR, Clk + 8000 Hz HPM” and repeat by clicking Record button.
 3. Repeat data collection for opposite ear.

END OF TEST SESSION

- Wake up the patient and
 1. Check earphone insertion depth (make sure earphone hasn't moved out).
 2. Then carefully remove the earphones.
 3. Remove electrode leads from electrode box.
- Use warm water to remove electrode paste.

Post-Auricular Muscle (PAM) Artifact

BEWARE OF PAM! If PAM is present in any or all of the responses, you will not be able to trust your Stacked ABR amplitude and you may not be able to trust the results of your CHAMP analysis.

PAM = post-auricular muscle artifact. It appears anywhere from 10 – 14 ms and can be present in one response condition, but not the following, and on one side, but not the other. Sometimes it's present in the click alone response, but disappears as soon as the noise is added. Sometimes it appears in just one or two of the noise conditions. A few of the more common causes are: (1) tension in the neck or jaw, (2) the head being turned to one side or the other, and (3) lack of support for the neck and/or head. **You MUST get rid of the PAM because it distorts the responses!**

Here are some helpful hints that sometimes work (but not always):

1. Make sure you remind the patient to keep his/her eyes closed and to relax his/her jaw. No teeth clenching!
2. Make sure the patient keeps his/her head straight. No tilting to one side or the other.
3. Try placing a folded towel under the patient's neck for support if #1 and #2 don't work.
4. If the patient is too tall for the recliner/chair, provide foot/leg support and ask him/her to slide down in the chair until his/her head is resting comfortably on the chair. You may need to provide lower back support (a towel/pillow).
5. If the patient is too short and his/her head and neck are at a funny angle due to the shape of the chair, place a pillow for support behind the patient's back or lower back (have him/her adjust it until he/she is comfortable).
6. Make sure the mastoid electrodes aren't sitting on muscle. Move the electrode if necessary (but keep as symmetrical as possible with respect to the opposite mastoid --> that is, if you move one, you should move the other).

Helpful Hints

To skip an individual protocol within the sequence, click on “Skip to Next Protocol” button during the 10 sec delay.

For noisy subjects:

1. If the first two runs do not meet the default residual noise criterion (20nV) even after stopping due to reaching max number (9728) of sweeps, then stop the sequence (by clicking the End Sequence button) and reinstruct subject.
2. Start sequence again.
3. If patient still does not meet the residual noise criterion after reaching max number of sweeps for 1-2 runs, end sequence and check the residual noise level reached displayed in the field tree.
4. Now change the residual noise stop criterion:
 - a. To reset the residual noise stop criteria for all SABR protocols, use the Noise Stop Criteria in the Collection menu and toolbar.
 - b. Or Select the first individual protocol.
 - c. Click either on the “Transducer” or “Amplifier” button, select Recording tab.
 - d. Set noise level stopping criterion just above residual noise level reached in noisy runs by selecting the level from the drop down list.
 - e. Modify the residual noise level for each individual protocol.
5. Run each individual protocol separately.

WARNINGS ABOUT RESIDUAL NOISE LEVELS

1. **If the residual noise level is ≥ 35 nV, don't use the data – it's too noisy.**
You must try to get the residual noise lower. If you can't, STOP! Data collected with such high residual noise is useless. Noise is random and can add or subtract from the true neural response. Some patients will be too noisy to test.
2. **If the residual noise level is ≥ 20 nV, the norms are not strictly applicable.**
Because the norms were set based on data collected with residual noise level ≤ 20 nV, when you have higher noise levels, you must take that into account when interpreting the results. In general, the higher the residual noise, the less reliable the results.
3. **Do not allow the residual noise levels to vary ≥ 5 nV for runs within one ear or between ears (if you plan on using the interaural measure).**
You should not do analysis when the residual noise levels between runs varies ≥ 5 nV because you're adding responses with varying amounts of noise. You must repeat the runs with higher residual noise levels.

Troubleshooting

High impedance despite repeated scrubbing

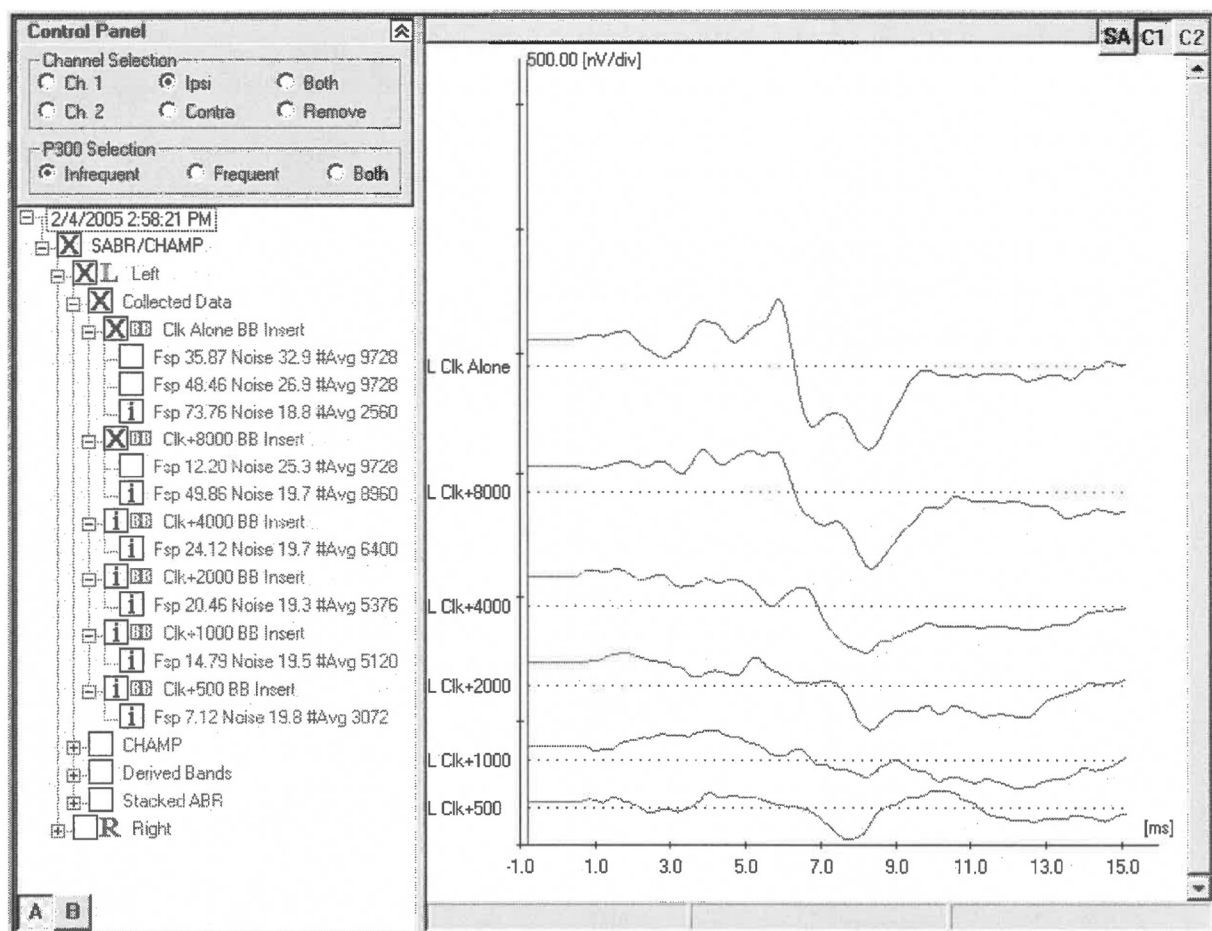
1. Make sure all the connections (electrode leads and cables to NavPro (DSP) box) are tight, then recheck impedance.
2. If impedance is still high, short out the electrode connections in the patient cable using jumper cables (see equipment prep notes on how to do this), and recheck impedance.
 - If all the impedances = 0, then everything is working properly and you just need to scrub again (try using alcohol to help remove any hair and/or skin conditioning products)
 - If the impedances are still high, then reboot system and recheck. If impedances remain high, then repeat and make sure you turn the power off. If impedances are *still* high, then check the following:
 1. electrode leads (switch in new ones and see if that helps)
 2. patient cable to NavPro (DSP) box (do loop test – ask Bio-logic for specific instructions)
 3. NavPro (DSP) box (call Bio-Logic)

Stacked ABR Normative data doesn't appear in the lower right corner of the screen:

1. For the single ear comparison norms to appear, you must enter the patient's gender.
2. For the percent interaural Stacked ABR difference to be automatically calculated and displayed, you must enter the patient's thresholds under "Audiogram" (minimum = four thresholds per ear) and the Hearing Threshold Averages (PTAs) must be within 10 dB. Remember, the PTA calculated by the program are averages of all the thresholds entered in the threshold table except for 250 Hz.

Important Warnings

1. **Make sure you check the stimulus.** We recommend listening to the stimulus before you test a patient (see instructions on how to check stimulus in manual under "Patient and Equipment Prep"). At minimum, we recommend that you check it once a week.
2. **Spend time before you start data collection to make sure the patient is comfortable and understands what to expect.** If you do so, the patient will be more relaxed and you will regain that time during data collection because you will have maximized your chances of collecting good data so that the test session will go much more quickly and smoothly.
3. **If PAM is present, you cannot trust the Stacked ABR or CHAMP.** You must get rid of PAM if it interferes with wave V in any of the high pass responses. If you can't get rid of PAM, STOP! Don't torture yourself or the patient!
4. **If the residual noise is ≥ 35 nV, don't use the data – it is too noisy.** You must try to get the residual noise lower. If you can't, STOP! Data collected with such high residual noise is useless. Don't torture yourself or the patient!
5. **Do not allow the residual noise levels to vary ≥ 5 nV for runs within one ear or between ears (if you plan on using the interaural measure).** You should not do analysis when the residual noise level between runs varies ≥ 5 nV because you're adding responses with varying amounts of noise. You must repeat the runs with higher residual noise levels.
6. **Make sure stimulus artifact does not exceed 3 ms.** To minimize stimulus artifact, make sure you do not clip the transducers to the patient's clothing. Have your electrode leads up toward the top of the head with the patient cable cord running down the backside of the patient. Have the transducers run down the front side of the patient's body. Do not have the patient and transducer cable coiled around each other. The software ignores artifact that occurs between zero and three milliseconds.



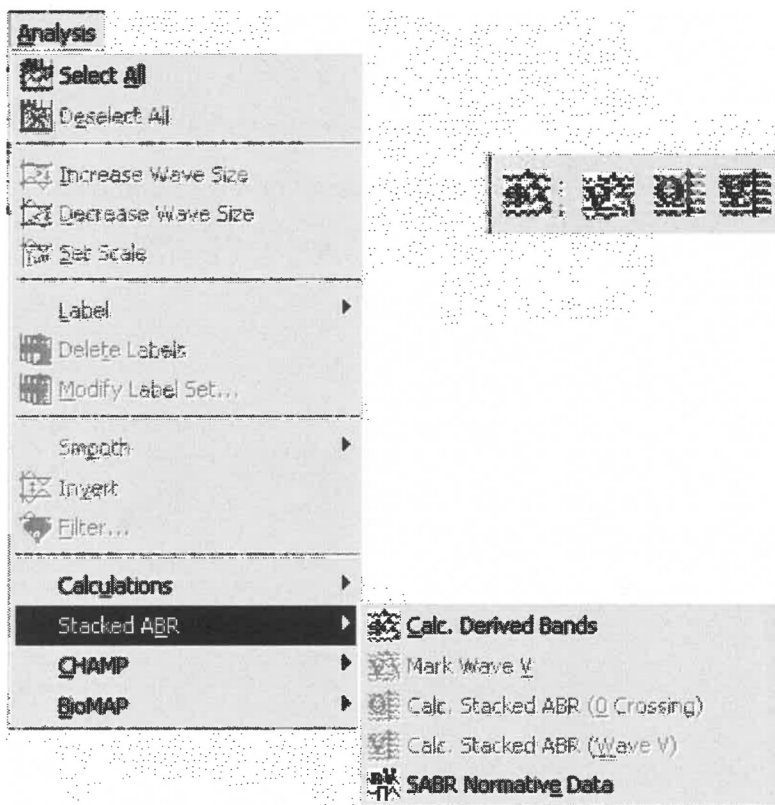
See Understanding the AEP Collection Field Tree and Panels section for additional explanation.

Collection Data Field Tree

- Choose from the field tree the waveforms to be displayed. You can easily open the field tree level by clicking in the box with the "+" sign or by right clicking on the level and selecting which level you want to open. The levels in order from top to bottom are:
 - Date and Time of Test Session
 - Test Type
 - Stimulus Ear
 - Data Collection Set(s): Collected Data, CHAMP (analysis), Derived Band (only for Stacked ABR), Stacked ABR (analysis)
 - Stimulus Type & Transducer Type – Verify correct transducer: BB Insert (Broadband) or ER2
 - Fsp (displayed but not used in Stacked ABR or CHAMP analysis), Noise (residual noise level), #Avg (total accepted sweeps)

ANALYSIS MENU AND STACKED ABR TOOLBAR

Analysis Menu and Stacked ABR toolbar



Icon and function		Description
	Calc. derived bands	Calculates the derived bands and integrated waveforms and auto-marks the Zero-crossing point. Available only if there is a full set of collected Stacked ABR waveforms (and only one of each test condition) on the active waveform display panel.
	Mark Wave V	Marks Wave V and V' for each derived band waveform. Optional function.
	Calc. SABR (0 Crossing)	Aligns the derived bands based on the Zero (0) crossing and calculates the amplitude of the Stacked ABR. This is the recommended calculation.
	Calc. SABR (Wave V)	Aligns the derived bands based on the Wave V and calculates the Amplitude of the Stacked ABR. This is an optional calculation; only available if Wave V is marked on all derived bands.
	SABR normative data view	Shows Stacked ABR calculations in comparison to the normative data.

Stacked ABR Analysis (using integrated waveforms)

Recommended Analysis Method

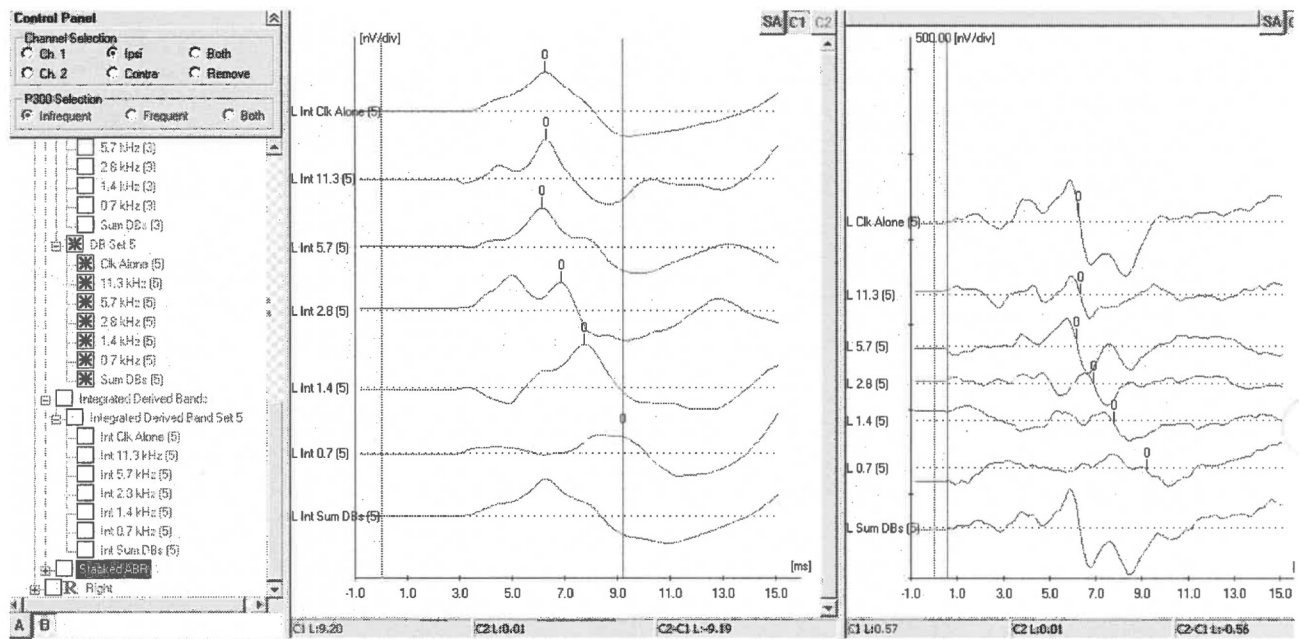
Load the Appropriate Records

1. Select waveforms from click alone and each high pass run under “Collected Data” section in the field tree for a total of 6 waveforms.
2. Review waveforms – select waveforms that meet the residual noise criteria and have no PAM (look at wave V latencies and check for undermasking).

Calculate the Derived Bands

1. Once one complete set of collected data (6 waveforms) for one ear is displayed, Click on the “Calc.

Derived Bands” icon . (Integrated waveforms will appear on Panel A and detrended derived bands will appear on Panel B).



Derived Bands

1. When the Derived Bands are calculated there are 2 data sets in the field tree: DB Set (derived band) and Integrated Derived Band. The DB set is the only one saved. Each time the data is analyzed, the DB set is saved and numbered. The DB set number corresponds to the Stacked ABR set number. The levels in order from top to bottom are:
 - Click Alone
 - 11.3 kHz
 - 5.7 kHz
 - 2.8 kHz
 - 1.4 kHz
 - 0.7 kHz
 - Sum DBs (sum of the derived bands) – should look similar to the Click Alone.

Panel A = Integrated Waveforms. Panel B = Detrended Derived Bands

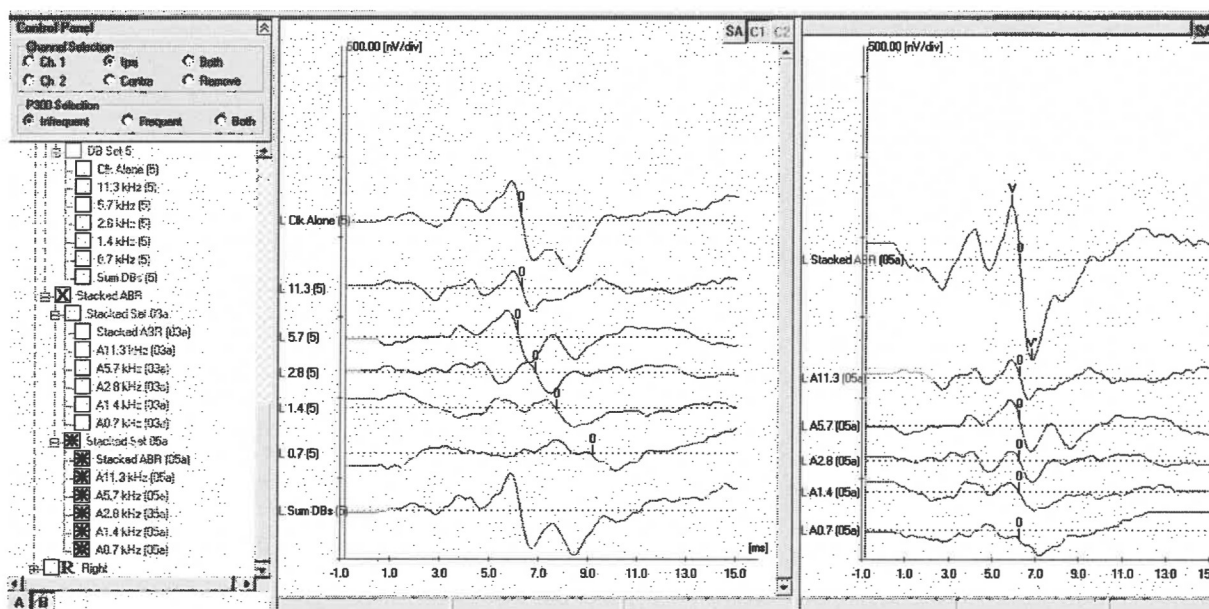
2. Review the waveforms (make sure to compare the sum of the derived bands to the click alone response) and check the zero crossings picked by the automatic peak-picking algorithm.
3. Correct the peaks on the *integrated waveforms (Panel A)* if necessary:
 - a. Select waveform by clicking on the waveform.
 - b. Move cursor to correct peak latency (point and click to move cursor in large steps or use arrows on keyboard to move by single points) – be sure to pick the peak before the largest and last trough in the integrated waveform.
 - c. Correct marking by clicking on the “0” icon – number 10 button on toolbar (note when you correct the peak on the integrated waveform on Panel A, the program automatically corrects the zero crossing on derived band on Panel B). The zero crossing will be on the downward slope of the Wave V on Panel B.

Keep in mind the patient's hearing thresholds! Due to either cochlear hearing loss or tumor-induced hearing loss, there may be one or more derived-bands that have either no peak or a peak at a latency that doesn't make sense. When this happens, mark the zero crossing at the same latency as the zero crossing in the click alone response on Panel B, so that the stacking program doesn't shift the band(s). Remember before you can stack the derived bands, a zero crossing must be marked on each one!

4. Rules for remarking the peak on the derived bands:
 - a. Remark the zero crossing on the Integrated Waveform (Panel A). This will remark the corresponding derived band waveform (Panel B).
 - i. If any waveform is not correctly marked, remark the zero crossing.
 - ii. If there is a broad peak, mark the waveform right before the downward slope.
 - b. Remark the zero crossing on the Derived Band (Panel B).
 - i. If the waveform is flat (no response), remark the zero crossing at the same latency as the click alone.

Calculate Stacked ABR

1. Click in Panel B with the detrended derived bands.
2. Click the “Calc. SABR (0 crossing)” icon .
3. Review derived bands (Panel A) and aligned derived bands + Stacked ABR (Panel B).
4. Compare amplitude of Stacked ABR wave V to norms provided in lower right corner or by clicking on the “SABR Normative Data View” icon .



Stacked ABR

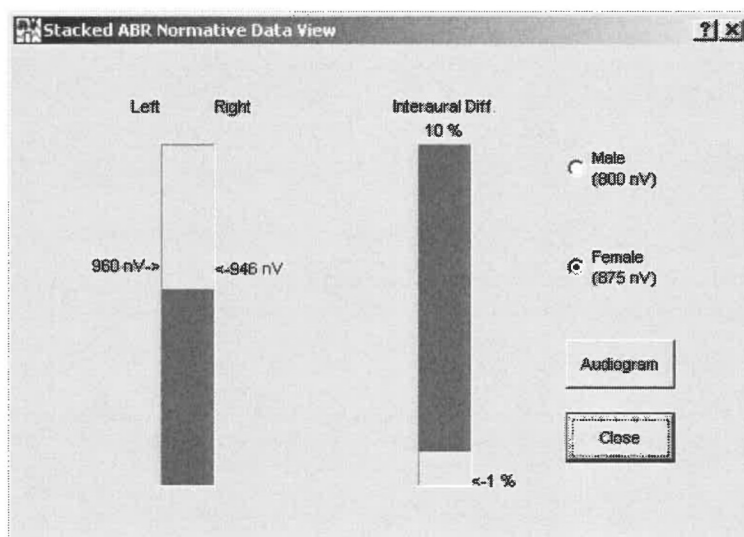
- The DB set is the only one saved. Each time the data is analyzed, the Stacked set is saved and numbered. The Stacked set number corresponds to the DB (derived band) set number. The levels in order from top to bottom are:
 - Stacked ABR
 - A11.3 kHz – A = aligned
 - A5.7 kHz
 - A2.8 kHz
 - A1.4 kHz
 - A0.7 kHz

Panel A =Derived Bands. Panel B = Stacked ABR and the Aligned Derived Bands

Interaural Comparisons

Display the Stacked ABRs for the left and right ears (by selecting them from the field tree) and look at the calculated interaural difference in lower right corner or by clicking on “SABR Normative Data View” icon .

Show Normative Data



Component	Description
Measurement bars	Displays the Absolute Amplitude for left and right ears & Interaural Difference in comparison to the normative data. Values in the Red area are NOT within normal limits.
Gender radio buttons	Select the radio button that identifies the gender of the patient. The normative data for the absolute amplitude is gender specific
Audiogram button	Displays an audiogram dialog box. See Audiogram section.
Close button	Closes the Normative Data View dialog box

Alternative Stacked ABR Analysis **(aligning wave V of the derived bands)**

Load the Appropriate Records

1. Select waveforms from click alone and each high pass run under "Collected Data" section in the field tree for a total of 6 waveforms.
2. Review waveforms – select waveforms with low noise and no PAM (look at wave V latencies and check for undermasking).

Calculate the Derived Bands

1. Once one complete set of collected data (6 waveforms) is displayed, Click on the "Calc. Derived Bands" icon  (integrated waveforms will appear on Panel A and detrended derived bands will appear on Panel B).
2. Review the waveforms (make sure to compare the sum of the derived bands to the click alone response) and check the peaks and troughs picked by the automatic peak-picking algorithm.
3. Correct the peaks on the *integrated waveforms*, if necessary (see integrated analysis for details on how to do this).
4. Click on "Mark Wave V" icon  (marks for waves V and V' will appear on the derived bands on Panel B).
5. Check the peaks and troughs picked by the automatic peak-picking algorithm (use the zero crossing to help you decide where to mark wave V).
6. Correct peak/trough, if necessary.
7. Select the derived band waveform by clicking on the waveform.
8. Place first cursor by selecting C1 (top of panel) on peak.
9. Place second cursor by selecting C2 (top of panel) on trough.
10. Maximize peak and trough amplitudes by toggling cursor back and forth (use arrows on keyboard). Make sure mouse cursor is not on another waveform.
11. Mark correct peak/trough.
12. With cursor on peak, click on "V" – "5" button on toolbar.
13. With cursor on trough, click on "V'" – "6" button on toolbar.

Keep in mind the patient's hearing thresholds! Due to either cochlear hearing loss or tumor-induced hearing loss, there may be one or more derived-bands that have either no peak or a peak at a latency that doesn't make sense. When this happens, mark Wave V at the same latency as Wave V in the click alone response on Panel B so that the stacking program doesn't shift the band(s). Remember that you must mark Wave V on each derived band! If you don't, you won't be able to stack the responses!

Calculate Stacked ABR

1. Click in Panel B with the detrended derived bands.
2. Click the "Calc. SABR (wave V)" icon .
3. Review derived bands (Panel A) and shifted derived bands + Stacked ABR (Panel B).
4. Compare amplitude of Stacked ABR wave V to norms provided in lower right corner or by clicking on "SABR Normative Data View" icon .

Interaural Comparisons: Display the Stacked ABRs for the left and right ears (by selecting them from the field tree) and look at the calculated interaural difference in lower right corner or by clicking on "SABR

Normative Data View" icon .

Stacked ABR Odds and Ends

Exclusion Criteria: Test all clinical ABR patients with normal standard ABR measures, unless they have:

1. Flat hearing loss ≥ 55 -50 dB
2. Conductive or mixed hearing loss
3. Residual hearing only at frequencies ≤ 750 Hz
4. Neurological disorders (e.g., MS, major head trauma, Huntington's disease, etc.)
5. Hyperacusis

Note: Meniere's patients are the exception because we sometimes see good responses even when the hearing loss is ≥ 55 -60 dB

Percent Interaural Stacked ABR Difference calculation: automatically calculated and displayed in lower right corner or on the "SABR Normative Data View" window *if the PTAs are within 10 dB.*

$$100 \times \left(\frac{(\text{larger Stacked ABR Amp} - \text{smaller Stacked ABR amp})}{\text{larger Stacked ABR amplitude}} \right)$$

Note: The interaural difference measure is only valid if the PTAs are within 10 dB. Any greater difference in PTA should be taken into account when interpreting the interaural difference. Note that the PTA referred to here is the one calculated by the program (and involves all thresholds entered in the threshold table except 250 Hz).

Norms (for mastoid electrode placement)

Females = ≥ 875 nV Males = ≥ 800 nV Interaural Differences < 10%
--

1. Once you've completed the Stacked ABR analysis for one ear, the amplitude of the Stacked ABR will be automatically calculated and displayed in the lower right corner or on the "SABR Normative Data View" window. If the patient's gender is entered, the correct gender specific normative data will also appear.
2. For interaural Stacked ABR amplitude calculations, make sure you've entered the patient's thresholds (minimum = four thresholds per ear), then display saved Stacked ABRs for the right and left ears. The interaural difference will be automatically calculated and displayed only when it is valid, that is, only when the PTAs are within 10 dB (see comment above on PTA and interaural difference).

Suspicious should be raised if either the suspected ear Stacked ABR amplitude is abnormal irrespective of the interaural value or if the interaural difference is greater than 10% irrespective of the value of the Stacked ABR in the suspected ear.

Keep in mind that 50% of all NF2 cases arise spontaneously (i.e., no family history). This means that on rare occasions, a tumor patient may be a spontaneous NF2 and both ears may be affected. In these cases, the interaural difference may be within normal limits but both Stacked ABRs could be abnormally low. Therefore, always remember to check the single ear distributions. If the suspected ear is within normal limits, then the interaural difference can be of value.

Also, note that the Stacked ABR amplitude may be reduced in patients who are age 50 and older. We cannot tell you how much the amplitude may be reduced until more analyses are completed. Until then, just keep in mind that when you test patients who are age 50 and older, the amplitudes may be reduced and you should consider other clinical test results (including the interaural Stacked ABR amplitude comparison if the PTAs are within 10 dB).

Stacked ABR Reminders

Patient Selection

1. IF THE STANDARD ABR MEASURES ARE ABNORMAL, THERE IS NO NEED TO DO THE STACKED ABR!! Only perform the Stacked ABR if the standard ABR measures are normal.
2. If the hearing loss is > 60 dB HL or so, you won't see much in the responses.
3. If the subject is older than age 50, his/her amplitudes may be affected by age-related factors (decreased amplitudes).
4. Exclusion criteria:
 - a. Flat hearing loss ≥ 55 -60 dB
 - b. Residual hearing only at frequencies ≤ 750 Hz
 - c. Conductive or mixed hearing loss
 - d. Neurological disorders (e.g., MS, major head trauma, Huntington's disease, etc.)
 - e. Hyperacusis

Note: Meniere's patients are the exception because we sometimes see good responses even when the hearing loss is ≥ 55 -60 dB

Patient and Equipment Prep

1. Check stimulus (prefer before every test session; min = once a week).
2. Make sure jumper cables are in place before running system (if patient isn't hooked up).
3. DON'T MIX-UP EARPHONES! (Bio-logic Broadband and ER2 for Stacked ABR; Bio-logic Inserts and ER3 for clinical ABR).
4. Check eartip:
 - a. Size - always try adult-size first
 - b. Type - Broadband (ER2) vs Insert (ER3)
 - c. Insertion depth (outer edge should be flush with opening to ear canal)

Test Session

1. Electrodes: vertex, not forehead!
mastoids, not earlobes!
2. Impedance ≤ 5 kOhms with difference ≤ 2 kOhms.
3. Make sure electrodes leads are plugged in correctly.
4. Make sure patient understands task and is comfortable!
5. DON'T MIX-UP EARPHONES! (Broadbands or ER2 for Stacked ABR; Inserts or ER3 for clinical ABR).
6. Start with the suspected ear.
7. No need to switch electrode inputs when you switch ears.

ER3 = Bio-logic Inserts
ER2 = Bio-logic Broadband

Pay special attention to the following:

1. PAM $\rightarrow$ you must get rid of PAM!
2. Noise: if subject is too noisy, see Helpful Hints (in manual) for what to do.
3. Make sure the residual noise level is < 35 nV and the same for each run (as well as for both ears if you plan to do an interaural comparison).
4. Make sure there is approximately the same number of sweeps per run, if possible.
5. Check for artifact stimulus artifact at beginning of response, don't worry about it unless it extends out to 3 ms.

Analysis

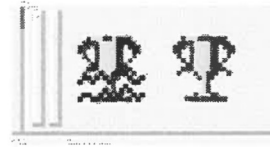
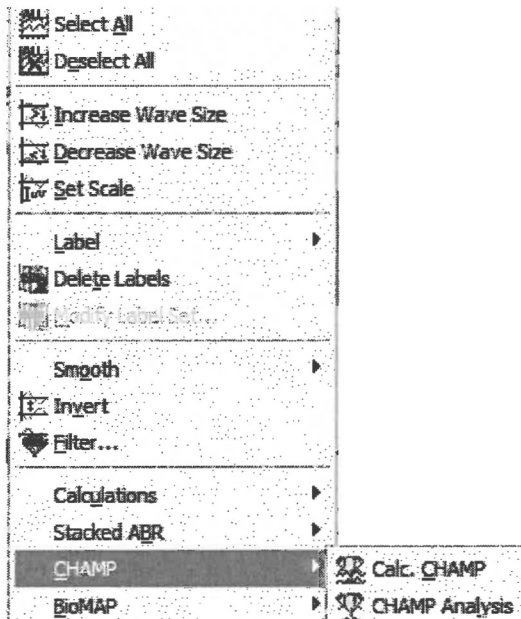
1. Check to see whether wave V moves out in latency for the lower high pass responses and derived bands.
2. Check for undermasking (highly correlated with Meniere's disease).
3. Make sure the sum of the unshifted derived bands approximates the click alone response.
4. **DON'T USE THE DATA** if PAM is present and/or residual noise level is high (≥ 35 nV).
5. Keep in mind the patient's thresholds when marking the waves.
6. Make sure you mark the peak in the integrated waveform right before the largest and last trough.
7. **DON'T** use the interaural difference if the PTAs are not within 10 dB.

Other

1. Clinical ABR - take advantage of Fsp + residual noise level criterion (40-50 nV).
Note: Sensitivity of clinical ABR (high level, slow rate) = sensitivity of click alone run of Stacked ABR protocol (60dB nHL, 45.5/sec).
2. Fsp (= variance across the average/variance of single point from sweep to sweep) good for threshold search.
3. Recommend using Integrated waveform analysis (instead of wave V peak picking analysis).
4. Meniere's disease with cochlear hydrops is highly correlated with undermasking in high pass responses.

ANALYSIS MENU AND CHAMP TOOLBAR

Analysis Menu & CHAMP toolbar



Icon and function		Description
	Calc. CHAMP	Calculates the Latency Delay between the wave V of the Click Alone response and the wave V of the Click + 500 Hz response. Available only if a collected set of data is present on the active panel.
	CHAMP analysis	Displays CHAMP calculation(s) in comparison to the normative data.

ANALYSIS MENU AND CHAMP TOOLBAR

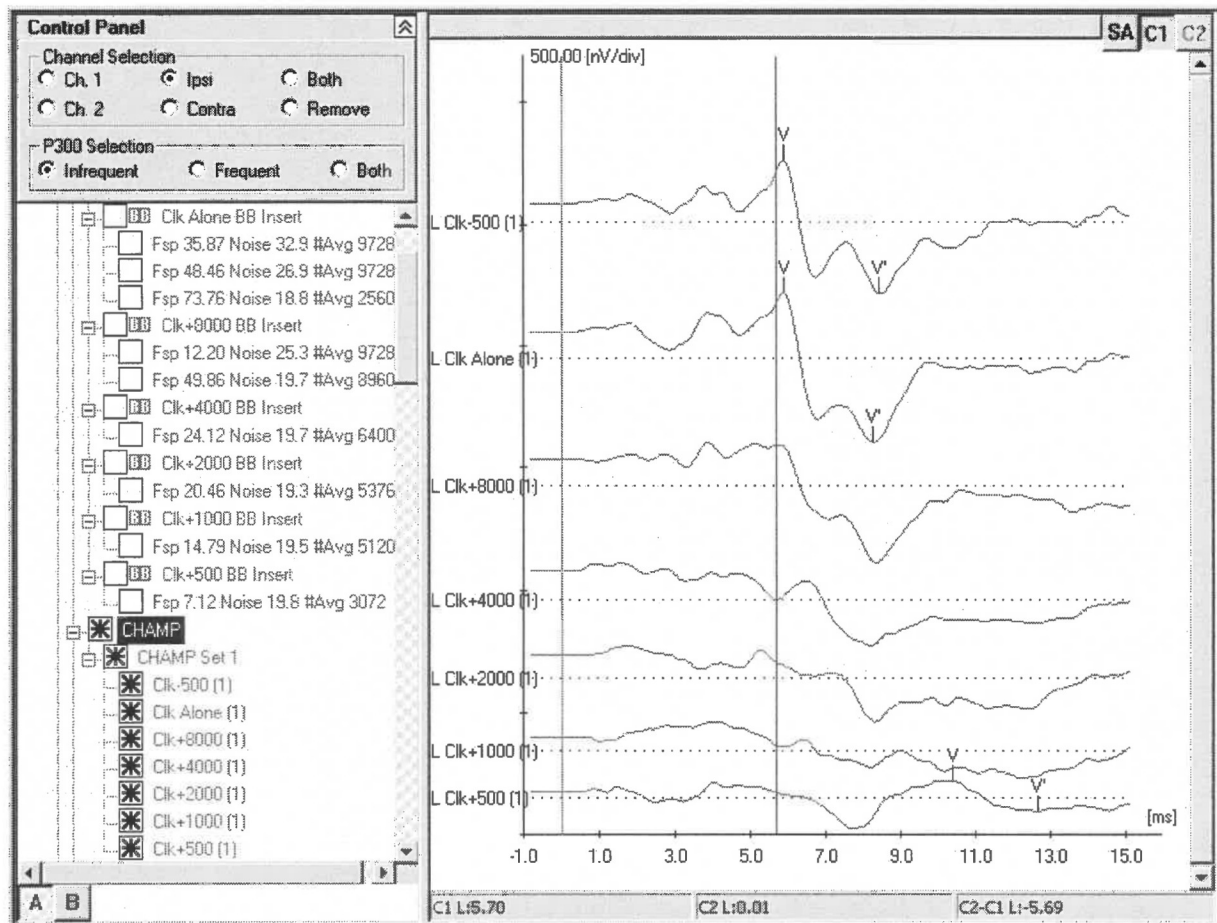
Cochlear Hydrops Analysis Masking Procedure (CHAMP) Analysis

Load the Appropriate Records

1. Select waveforms from click alone and each high pass test condition under “Collected Data” section in the field tree for a total of 6 waveforms.
2. Review waveforms – select waveforms that meet the residual noise criteria and have no PAM.

Calculate CHAMP

1. Once one complete set of collected data (6 waveforms) is displayed, Click on the “Calc. CHAMP” icon



2. Each time the CHAMP data is analyzed, the CHAMP set is saved and numbered. The levels in order from top to bottom are:
 - Click – 500 (calculated wave with V and V' automatically marked)
 - Click Alone (with V and V' automatically marked)
 - Click + 8000
 - Click + 4000
 - Click + 2000
 - Click + 1000
 - Click + 500 (with V and V' automatically marked)

ANALYSIS MENU AND CHAMP TOOLBAR

2. Check the peaks and troughs picked by the automatic peak-picking algorithm on the Click Alone, Click +500 Hz high pass masking and the calculated Click-500 Hz waveforms.
3. Correct peak/trough, if necessary. To remark the label on the peak/trough:
 - a. Select the waveform by clicking on it.
 - b. Place first cursor by selecting C1 (top of panel) and clicking on the waveform peak.
 - c. Place second cursor by selecting C2 (top right of panel) and click on the waveform trough.
 - d. Maximize peak and trough amplitudes by toggling cursor back and forth (use arrows on keyboard) to find the largest amplitudes.
 - e. Mark correct peak/trough.
 - f. With C1 cursor on peak, click on "V" – "5" button on toolbar.
 - g. With C2 cursor on trough, click on "V" – "6" button on toolbar.

To help you determine which peak to mark in the 500 Hz high pass response, set the cursor at the latency of wave V in the Click Alone response and look at the latency of wave V in each of the high pass responses. In non-Meniere's disease/cochlear hydrops patients, wave V will move out in time as more high pass masking is added. In Meniere's disease/cochlear hydrops patients, wave V will not change much in latency as more high pass masking is added. Remember to keep in mind the patient's hearing thresholds!

12. Compare the Latency Delay and Amplitude Ratio to the norms by clicking on "Show CHAMP Analysis" icon . If the results are not within normal limits, the value will be displayed in red.

CHAMP Analysis		
Calculation	Left	Right
Latency Delay (ms): (Norm: > 0.30 ms)	5.06	4.44
Ratio: (Norm: > 0.95)	1.04	0.99

ANALYSIS MENU AND CHAMP TOOLBAR

CHAMP Odds and Ends

Exclusion Criteria: Test all clinical ABR patients unless they have:

- Flat hearing loss ≥ 65 -70 dB
- Conductive or mixed hearing loss
- Neurological disorders (e.g., MS, major head trauma, Huntington's disease, etc.)
- Hyperacusis

Latency Delay

For the latency delay, always pick wave V in the 500 Hz high pass response when it's present. Pick the undermasked wave V only when you cannot identify wave V!

To help you determine which peak to mark in the 500 Hz high pass response, set the cursor at the latency of wave V in the Click Alone response. Then look at the latency of wave V in each of the high pass responses as you move from the 8 kHz high pass response to the 500 Hz high pass response adding more and more high pass masking. In general, in non-Meniere's disease/cochlear hydrops patients, wave V will move out in time as more high pass masking is added. In Meniere's disease/cochlear hydrops patients, wave V will not move out in time as more high pass masking is added. But keep in mind the patient's hearing thresholds because hearing loss will also influence if and when wave V shifts out in latency as more high pass masking noise is added.

Amplitude Ratio

The Amplitude Ratio is calculated as follows:

Amplitude of V- V' for Click –500 Hz / Amplitude for V-V' for Click Alone

Norms (for mastoid electrode placement)

Normative Data

Latency Delay > 0.30 ms
Amplitude Ratio > 0.95

Miscellaneous

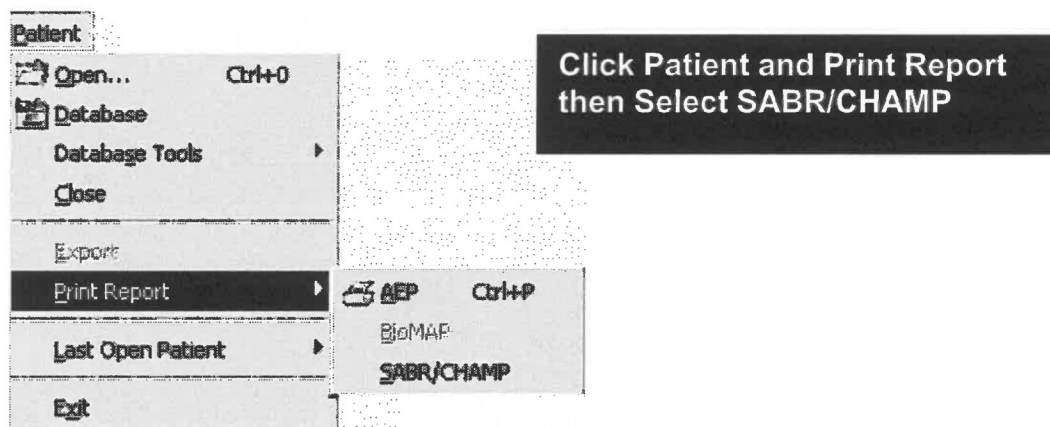
CHAMP calculations are single ear measures. There is no interaural CHAMP measure.

If either of the results are abnormal, then you should suspect the presence of cochlear hydrops. Do not assume that the patient has Meniere's disease! You must take into consideration the full clinical picture!

These measures are the subject of ongoing research and the calculations performed in CHAMP may undergo changes over time. You must make sure you understand their limitations.

PRINT STACKED ABR/CHAMP REPORT

Print Stacked ABR/CHAMP Report



Select (click on) Print Report item then select SABR/CHAMP to launch a Stacked ABR or CHAMP Report screen. The report will default to either SABR (Stacked ABR) or CHAMP depending on the data you have displayed on the collection panels.

If you perform a Standard ABR using an AEP protocol, the Wave V interaural time delay (IT5) or Wave I-V interpeak latencies will not display in the SABR report. Print this information using an AEP report. See Print AEP Report section.

BioMAP Data Collection

Patient and Equipment Prep

Patient Prep

1. Verify that the patient does not meet any of the exclusion criteria:

The BioMAP (Biological Marker of Auditory Processing) is a neurophysiological test used to quickly and objectively identify disordered processing of sound that has been associated with learning impairments in many children. Additional information can be obtained at <http://www.communication.northwestern.edu/brainvolts/clinicaltechnologies/>. Users should not perform the test when any of these conditions exist:

- Conductive, mixed, or sensorineural hearing loss (The audiogram should be recent). Do not assume that because immittance measures are normal that an air/bone gap does not exist. Perform bone conduction audiometry to verify that a conductive or mixed hearing loss is not present.)
- Abnormal waveform morphology on a standard click ABR
- Neurological disorders such as multiple sclerosis, Huntington's disease, or major head trauma.

Remember: The current normative data were collected on children between the ages of 8 to 12 years. The normative data were collected with the child observing a video of his/her choice with the sound level turned low and with the left ear open so the child could hear the audio of the movie at a low level. Be aware that some televisions do produce electrical noise that can interfere with data collection or introduce noise into the BioMAP data, so if the child will cooperate for the test without this distraction technique, it is fine to collect with no video shown. Use of a battery-powered DVD device for playing the video for the child may help to reduce the chance of electrical interference. The child should not be allowed access to the device for changing volume or fast-forwarding, etc. On average, the BioMAP test procedure can be performed in approximately 20 minutes.

Note: You must perform a Standard Click ABR first at a high level (80 dB nHL). Verify that the ABR waveform morphology and latencies are normal. You must rule out any hearing loss or abnormal click ABR responses. If the click ABR is abnormal in any way, or if you find through other evaluations that the child has a hearing loss or conductive involvement, please do not test this child using BioMAP since the norms will not apply.

2. Supplies Needed:
 1. Gauze pads or cotton applicators
 2. Skin prep gel
 3. Electrode paste
 4. Electrodes – **you must use non-disposable electrodes**
 5. Insert Earphone (Bio-logic Sinser or ER3) and ear tip for right ear.

Equipment Setup

1. Make sure the standard **Bio-logic Inserts or ER3** (not the Bio-logic Broadbands or ER2) earphones are plugged into the NavPro (DSP) box.
2. Enter patient information. It **must** include birthdate.
See Opening a Patient File section & Audiogram section.
3. Perform a Listening Check – See Performing a Listening Check section.

BioMAP DATA COLLECTION

Test Session

INTRO

Before you begin, inform the patient what you are going to do:

Briefly describe session:

Prep - 3 recording electrodes → measure & mark, clean with prep gel, place using water-soluble paste

During test → sit in recliner or lie on a table/cot, hear fast speech sound in the right ear, no need to respond, just relax, watch video if available. Patient should NOT be asleep or fall asleep during the test.

ELECTRODES

BioMAP uses one amplifier channel and ground for a total of 3 electrodes. You must always use these 3 sites, Cz, right earlobe and left earlobe, in order to assure reliable comparisons of your patient's BioMAP results with the normative data.

Only use non-disposable electrodes of the same metal type (i.e. silver, silver chloride, or gold). See Electrode Connections for Bio-logic AEP Systems section

Part the hair and use hair bands or clips to secure hair away from the general area of the electrode sites. Select the mid point at the top of the patient's head (Cz). After electrodes are applied, give the patient a final chance to use the restroom.

TEST SESSION

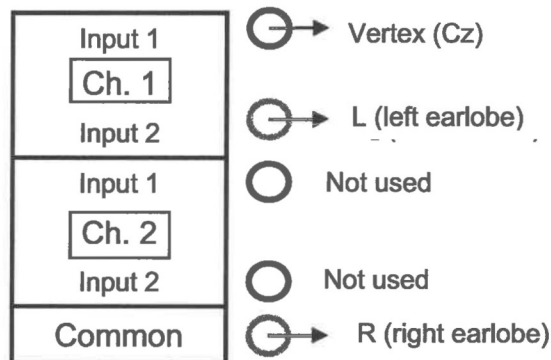
- Reinstruct patient.

When you are ready to begin the test procedure, instruct the patient as follows:

“During the test you will hear a fast speech sound “da” in the right ear. Please do not respond, just sit quietly. It would be best if you can relax and sit very quietly. You can listen to the video in your left ear (if available and as needed). Do not move around. The more relaxed you are, the faster the test will be completed. Remain awake for the duration of the test. If you need to move, the best time is when there is no sound.

PREP FOR BioMAP DATA COLLECTION

- Make patient comfortable (blanket, pillow, remove shoes, etc.)
- Put feet up and push recliner back
- Electrodes:
 1. Check electrodes (press on them), then tape leads to chair.
 2. Remove any jumper cables, then connect electrode leads as follows.



Although we are testing the right ear, the electrode switching feature enabled in the protocol will use the correct electrodes for the Channel 1 amplifier inputs.

BioMAP DATA COLLECTION

- Check impedance
 1. Click on Impedance button .
 2. Make sure impedance is ≤ 5 kOhms for each electrode and the difference between the measurements is ≤ 2 kOhms.
- Instruct patient (keep head straight, relax, move only when no sound, etc.).
- Ensure proper placement of earphones, then tape earphone cable to blanket or chair.
 1. Ear tip should be inserted into the Right ear (For BioMAP you will be testing right ear only)
 2. Make sure outer edge of foam on eartip is flush with outer edge of the right ear canal.
 3. Clip transducer to blanket or shirt (do not allow transducer to sit on patient's skin).
- Double-check everything.
- Close the booth door(s).
- Recheck impedance before starting test session.
- Give the patient a moment to relax.

BioMAP DATA COLLECTION

- Choose AEP protocol for Standard Click ABR
 1. Select a protocol: ABR (1 Channel, 21.33 ms window) is recommended
 - a. Remember if the Standard Click ABR is abnormal – Do NOT perform the BioMAP.
 2. Select “BioMAP:BioMAP default” protocol to run the BioMAP.

NOTE: BioMAP protocols should not be modified. These protocols have been optimized for obtaining BioMAP data. Any modifications to these protocols would result in data that are incompatible with the normative data.
- 4. Click on View EEG  first to ensure the patient is calm and then click the Record button  to start.
- 5. Collect three trials of the BioMAP response completing the full 2000 sweeps for each trial.
- 6. Click on the three BioMAP waveforms while holding down the ctrl key and make sure that only these 3 waves are selected on the waveform panel.
- 7. Select the weighted add toolbar icon to average these three waves together.

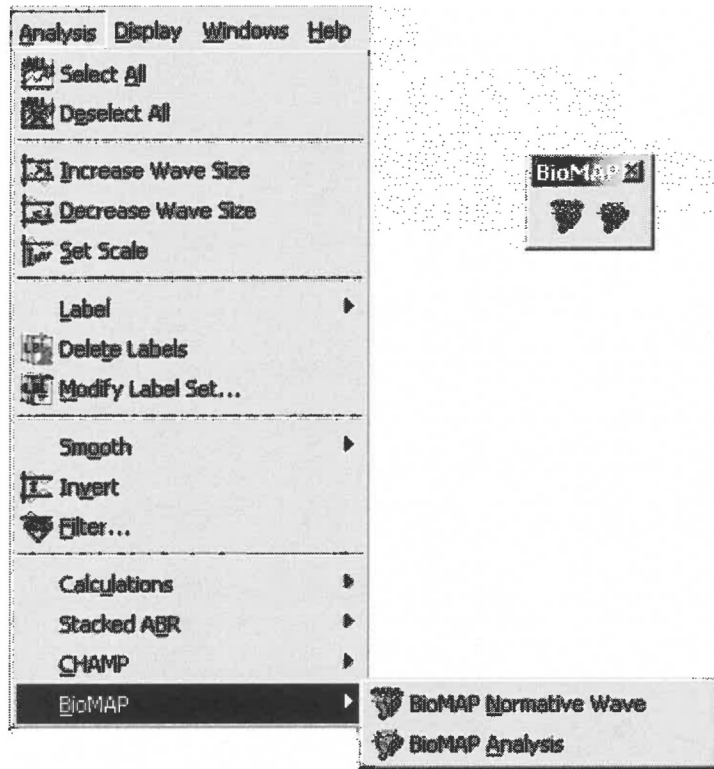
COLLECTION DATA - FIELD TREE

- The collected waveforms are listed in the field tree to the left of the waveform panels. Listed below are the levels in order from top to bottom are listed below:
 - a. Date and Time of Test Session
 - b. Test Type
 - c. Stimulus Ear (should always be R for right)
 - d. Stimulus (BioMAP uses a custom speech stimulus) & Transducer Type
 - e. Polarity & Masking
 - f. #Avg (total accepted sweeps)

END OF TEST SESSION

- Check patient:
 1. Check earphone insertion depth (make sure earphone hasn't moved out) and carefully remove the eartips.
 2. Then carefully remove the earphones.
 3. Remove electrode leads from electrode box.
- Use warm water to remove electrode paste.

Analysis Menu and BioMAP toolbar

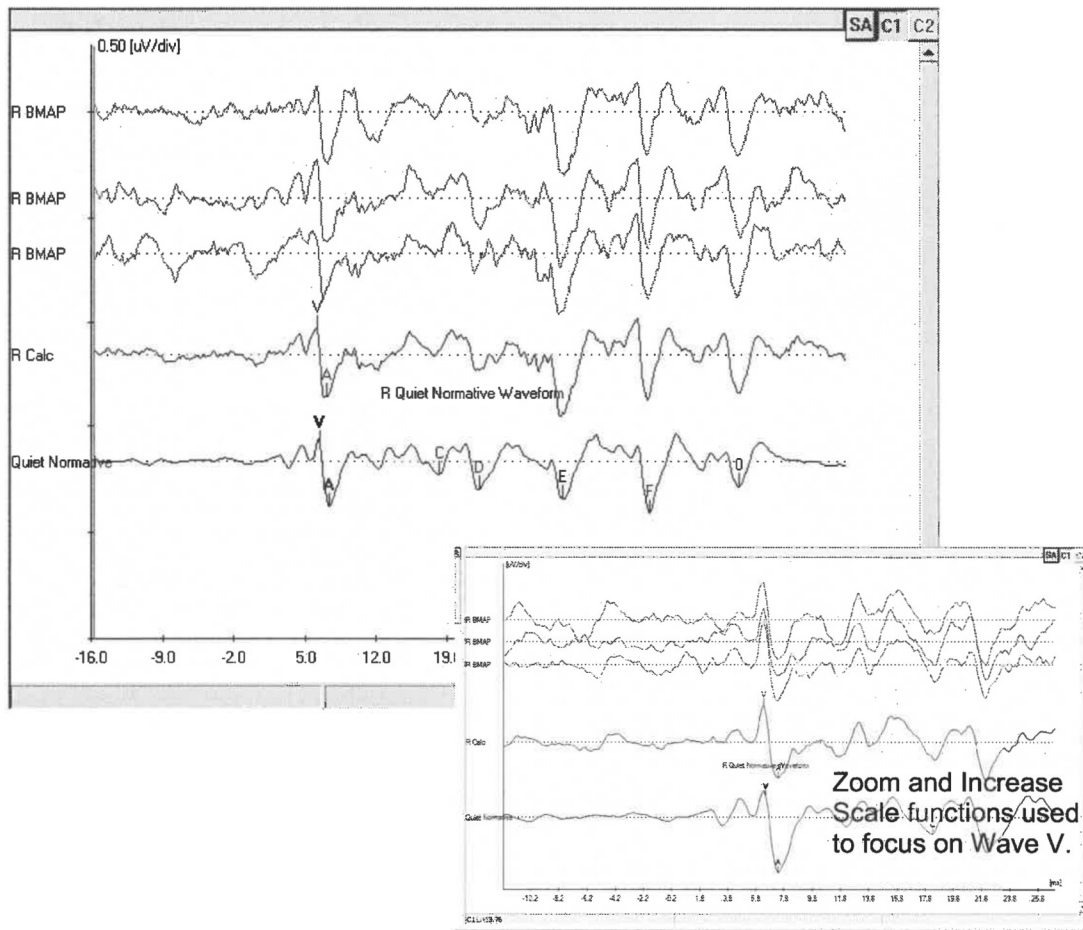


Icon and function		Description
	BioMAP Normative Wave	Displays the normative wave to assist in correctly marking the waveform.
	BioMAP Analysis	Displays the BioMAP analysis and score.

BioMAP – Marking the Calculated Waveform

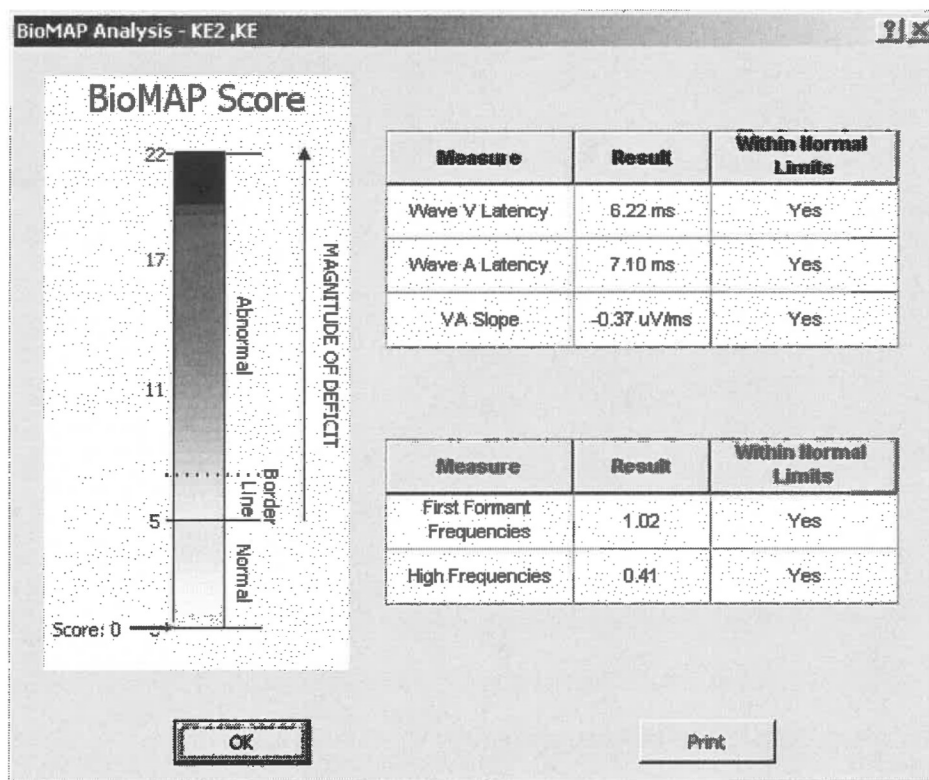
1. Click on the BioMAP Normative Wave icon to display the normative wave which will assist you in marking labels on the calculated waveform. The normative wave has several markings for your reference but only V and A need to be marked on the calculated waveform in order to perform the analysis.
2. The three 2000 sweep trials and the normative waveform should be used as a guide for marking the calculated waveform. On the calculated wave, identify and mark wave V and A (trough of wave V).
3. Zoom  can be used to assist in identifying the proper location for the markings. See Display Menu and Display toolbar section.
4. Additionally, the waveform panel can be expanded horizontally by clicking on and dragging the splitter control that separates the two waveform panels.
5. It may also be helpful to select all of the waves and increase the size of the waveforms using the increase size  toolbar icon.

BioMAP DATA COLLECTION



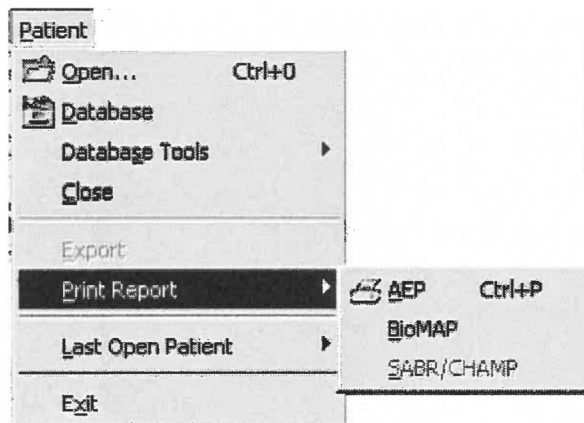
6. Click on BioMAP Analysis icon to display the BioMAP score and analysis. See Analysis Menu and BioMAP toolbar section.
7. If the result is not within normal range, close the BioMAP Analysis window and verify that the markings of V and A on the calculated waveform are correct. If you move the markings, click on BioMAP Analysis again to determine if the changing of the markings changes the results outcome.

BioMAP Analysis



Component	Description
BioMAP Score	Displays a composite score derived from the 5 measures listed below and whether that value is considered within normal limits, borderline normal or abnormal and, if abnormal, where along the magnitude of deficit it falls.
Wave V Latency	Displays the latency of wave V and whether it falls within normal limits.
Wave A Latency	Displays the latency of wave A (wave V trough) and whether it falls within normal limits.
VA Slope	Displays the slope of wave V to wave A and whether it falls within normal limits. Slope Calculation: (wave V to A amplitude)/(wave V to A latency).
First Formant Frequencies	Displays the average amplitude for frequencies between 456 Hz to 720 Hz and whether it falls within normal limits.
High Frequencies	Displays the average amplitude for frequencies between 721 Hz to 2000 Hz and whether it falls within normal limits.
OK button	Closes the BioMAP Analysis window.
Print button	Prints the BioMAP Analysis window.

Print BioMAP Report



Click Patient and Print Report then Select BioMAP

Select (click on) Print Report item then select BioMAP to launch a BioMAP Report screen. The data must be labeled for the BioMAP print option to be available. The report will default to either a BioMAP Normal or BioMAP Abnormal template depending on the data you have displayed on the collection panels.

BioMAP Frequently Asked Questions

Answers provided by the BioMAP developers at Northwestern University Auditory Neuroscience Laboratory.

How much artifact is acceptable?

Ideally, we try to keep the artifact rejection rate below 10% but have found that we can get acceptable responses with up to 20% rejection.

Can mastoid electrode placement be used rather than earlobe and can high forehead be used rather than CZ placement?

Inferring from the similarities between Cz/Fz and mastoids/earlobes, we think these are probably acceptable alternatives, but due to the lack of norms, we cannot endorse other electrode montages at this time.

Can disposable electrodes be used rather than standard cup electrodes?

In theory, any good set of metal-matched electrodes placed on the patient with low and balanced impedances should be able to collect acceptable data. However, in practice, disposable electrodes typically do not adhere well enough to achieve low and stable impedance values when placed on the scalp over hair. Since Cz is the recommended electrode placement for the non-inverting electrode, disposable electrodes are not recommended.

Can I just perform one run of 6000 sweeps rather than averaging together 3 runs of 2000 sweeps?

The system is capable of doing this, but it is not the recommended procedure. Reviewing the three individual waveforms allows you to assess reproducibility of the waves and helps improve your peak picking accuracy. Sometimes ambiguity in the grand average is clarified when the sub-averages are inspected.

I get referrals for children aged 6-7 and 13-15. Can I still perform the test?

Yes, but with a few caveats. Clinicians should inform parents and referral sources that there are no norms on children younger or older than the target 8-12 year old range. However, unpublished data on younger and older children indicate no differences across the 6-15 age range. The information in a 6-7 year old can be helpful in guiding diagnosis and treatment: a normal score should be readily interpretable as normal. However, an abnormal score should be viewed with some caution. There would definitely be a suspicion of a neural encoding of speech problem; however, a retest at age eight would be advisable.

How do I interpret results when the BioMAP score is in the normal range but one or more of the individual response parameters are outside of the normal range?

We expect individual response parameters to fall outside the normal range sometimes - disregard that information for clinical interpretation and recommendations.

Do I interpret a score of 6 differently from a score of 20? or make different recommendations?

Yes, it's a matter of degree of severity - one would have more confidence about the existence and severity of an auditory speech encoding deficit with a higher BioMAP score.

Within the normal score range, can anything be inferred from a score of 0 versus a score of 4?

No

What specific auditory training programs have been found to benefit children with abnormal BioMAP scores?

The only one tested in research conducted at Northwestern's Auditory Neuroscience Laboratory is Earobics. One can infer that benefits may occur with other auditory, phonetically-based programs, e.g. Fast ForWord, but no supporting data exist.

For a complete work up at Northwestern University, what tests, other than BioMAP, are performed?

A typical test battery includes standard audiometry, tympanometry, Dichotic Digits, Pitch Pattern Sequence and Low-Pass Filtered words tests. For a complete CAP evaluation, the following tests can be administered: Time Compressed Speech test, Time Compressed Speech test with Reverberation, Staggered Spondaic Words test, Competing Sentences test, Duration Patterns Test and the Random Gap Detection Test.

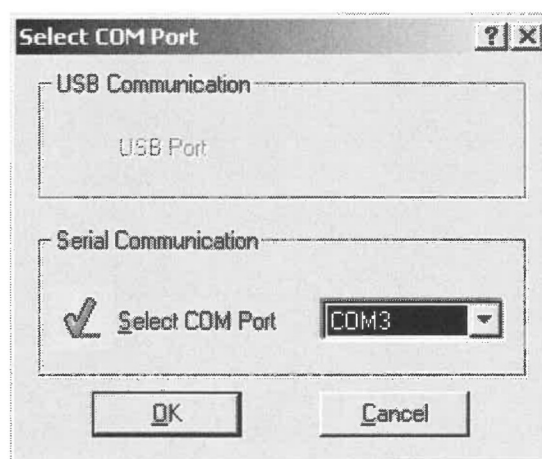
TROUBLESHOOTING MENUS

Hardware Setup menu



Component	Description
Set Com Port	Sets the Com Port to which the Navigator Pro box is connected. This is used for Navigator Pro boxes that are connected to the laptop using a serial connection.
Enable Hardware	Enables the AEP software to locate the Navigator Pro box.
Self Diagnostic	Assesses the integrity of the amplifier and output to the transducer, and calibrates them. See the Self Diagnostic section.
Set Notch Filter	Sets the 60 or 50 Hz notch filter. See Protocol – Amplifier Tab section for how to initialize the notch filter.
Set SABR/CHAMP Transducer	Sets the Stacked ABR or CHAMP transducer. See Stacked ABR & CHAMP Data Collection – Equipment Setup section.

Set Com Port



Choose the Com Port to which the Navigator Pro box is connected. This feature is only needed for Navigator Pro boxes that are connected to a serial connection. Click OK to save the Com Port location. Click Cancel to exit the Select Com Port dialog box without saving any modifications.

Self Diagnostic

The Navigator Pro hardware module contains components responsible for the stimulus output to the transducer and an amplifier that increases the incoming signal from the electrodes. Within the AEP software there is a Self Diagnostic procedure that can be performed which assesses the integrity of these components and calibrates them.

To perform the Self Diagnostic Procedure:

1. Plug the Navigator Pro system in and turn it on so that all components are receiving power.



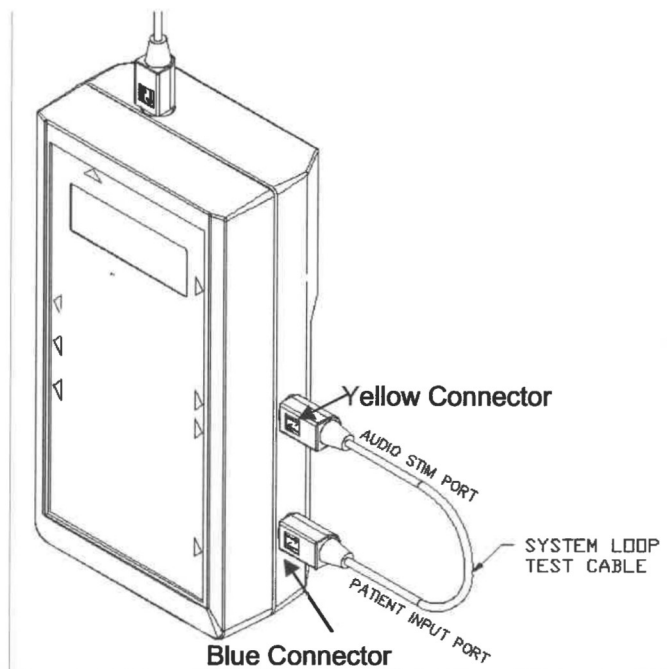
CAUTION

Be careful not to twist the patient electrode cable and transducer connectors as you remove them. Metal pins inside the connectors can be bent or broken by twisting, using excessive force, or if they are not positioned correctly.

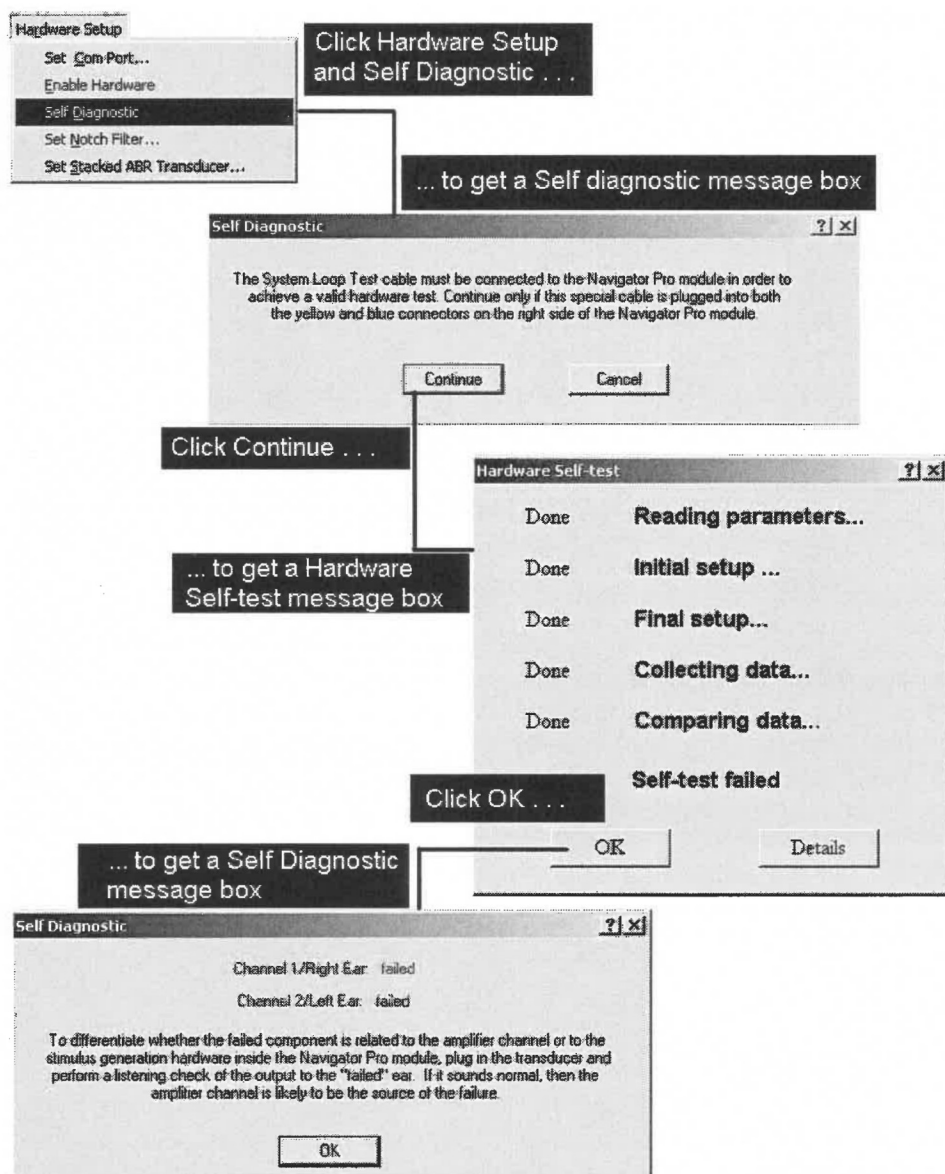
ATTENTION

Faites attention de ne pas tordre le câble de l'électrode du patient et les connecteurs du transducteur en les enlevant. Les broches métalliques à l'intérieur des connecteurs peuvent être tordues ou cassées par la torsion, la force excessive ou si elles ne sont pas correctement placées.

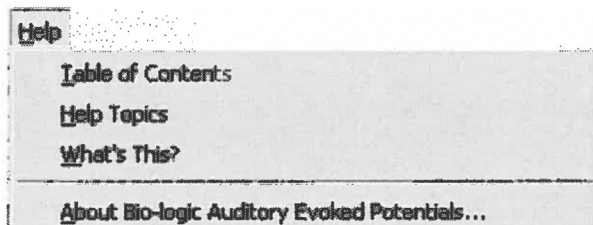
2. Pull the patient cable and transducer cable connectors straight out of the Navigator Pro unit.
3. Connect the system loop test cable (part number: 541-TSTCBL) to both the blue and yellow-ringed sockets on the right side of the Navigator Pro system by matching the connector color to the color ring around the socket. Make sure the flat side of the molded connector faces the label side of the box. Be sure to push the connector into the socket as far as it will go.



After you have setup the navigator Pro system:

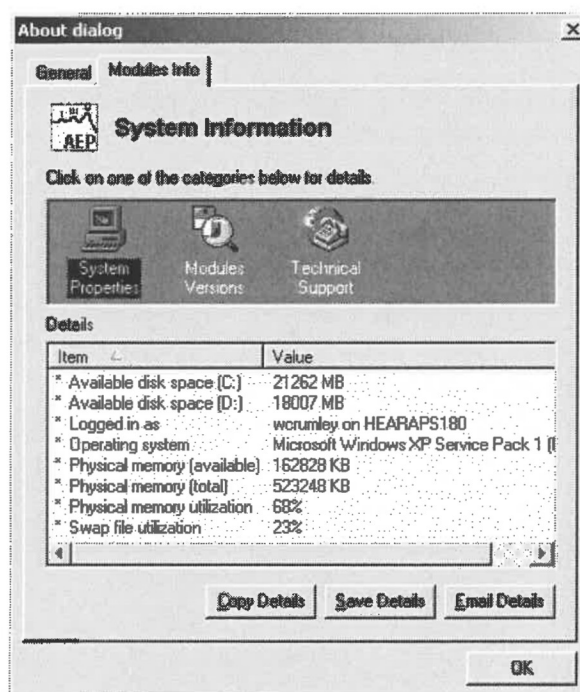


Help Menu



Component	Description
Table of Contents	Currently Under Development
Help Topics	Currently Under Development
What's This?	Currently Under Development
About Bio-logic Auditory Evoked Potentials	Provides General Information, the Software Version and Bio-logic Systems Corp contact information and provides modules information, the computer system information and critical file information.

About Bio-logic Auditory Evoked Potentials – Modules Info



This process only needs to be performed if directed to do so by Bio-logic Technical Support. Choose a System Information category (System Properties or Modules Versions). Click on Save Details and designate the location where you want this information saved and a name for the file. Burn this file to a CD or other medium that will allow you to send it in to Bio-logic Technical Support for evaluation.

Alternately, you can click on Email Details to send this information thru Outlook Email if your system has this capability. Click OK to close this dialog box. Copy Details function is under development.

Bio-logic Systems Corp

Auditory Evoked Potential Troubleshooting Guide

Noisy recordings and Excessive artifacts

Patient variables

Post-auricular muscle reflex occurs at a latency of 10-15 msec. It can be so large in amplitude that it prevents averaging or obscures the response.

- Use ear lobe placement of electrodes rather than mastoid.
- Check patient state.
- Place a pillow under the patient's neck for support. Encourage patient to relax, close their eyes, and avoid clenching their teeth.
- Ensure electrode impedance is low (≤ 5 kOhms) and balanced (inter-electrode difference ≤ 2 kOhms).

Equipment variables

Pause averaging and check for stimulation artifact in EEG.

- Separate sources of electromagnetic energy (power cable, stimulus cable, transducers, computer, monitor) away from cables carrying patient response (patient cable, pre-amplifier, pre-amp cable).
- Braid the electrodes to improve common mode rejection.
- Make sure that all electrodes are of the same metal type.
- Re-chloride electrodes, if necessary.
- Separate NavPro box from isolation transformer.
- Ensure the patient cable (blue connector) and transducer cable (yellow connector) are fully inserted.
- Bone conduction: Stimulation artifact is common. Physically separate electrodes from oscillator and use alternating polarity. Place electrodes on the front of ear lobe.

Environmental variables

- With medical approval, temporarily disconnect patient from other equipment.
- Place the electrodes in a glass of water and position the glass in the location where the patient's head is usually positioned. View the EEG signal on your system. If electrical interference is evident: Try moving the glass of water to a different location. If you find a quieter spot, reposition the patient chair/bed to that location.
- Turn off electrical equipment in the test environment (cellular phones, pagers, computer monitors) and in adjacent rooms, if possible.

Noisy recordings and Excessive artifacts

60 (50) Hz interference

- Only rarely is 60 or 50 cycle noise the cause of noisy recordings or artifacts. Using a notch filter frequently produces ringing which increases artifacts. So, to check for true 60 (50) Hz interference, temporarily enable the notch filter. If the problem goes away, find and correct the source of the noise so that the notch filter may be disabled during actual data collection.
- Turn off fluorescent lights or lights with dimmer switches. Test the outlet to make sure it is grounded.
- In some cases, it will be necessary to install a dedicated electrical outlet or shield the test environment.

High or open impedance**Equipment variables**

- Make sure the patient cable/pre-amp cable and transducer are securely coupled to the Navigator Pro.
- Exchange the electrodes between two inputs to see if the problem follows the electrode.
- Try a different set of electrodes.
- Perform internal diagnostics loop test procedures.
- Perform internal diagnostics/internal calibration of Navigator Pro.

Software/Protocol variables

- Shorten the analysis window to 9 msec or less.
- Change the click rate slightly.
- Use a post-stimulation time (+1) or add blocked points.
- Decrease gain on all channels in one or two increments (e.g. Reduce 150,000 to 100,000; reduce 100,000 to 75,000).
- Use alternating polarity.
- Reduce high filter (low pass) to 1500 Hz.
- Disable the artifact rejection as a last resort. Check if any useful, readable data can be collected. Interpret with caution as noise is being averaged into the recording.

Bio-logic Systems Corp

Stacked ABR/CHAMP Troubleshooting Guide

Noisy recordings and Excessive artifacts

Patient variables	Equipment variables	
Carefully apply electrodes and position transducer(s). Place patient in a reclining position and then enter data into the program. Allow the patient to relax before beginning test. This will effectively reduce noise levels at the beginning of the test. ◆ Check patient state. Encourage patient to relax. ◆ Sleep is best. If patient cannot sleep, have them lie in a comfortable position, close their eyes, and avoid clenching their teeth. ◆ Place support under the patient's neck. ◆ Be sure that all possible sources of PAM are eliminated.	Check for artifact in EEG. Separate sources of electromagnetic energy (power cable, stimulus cable, transducers, computer, monitor) from cables carrying patient response (patient cable, electrode leads). Check for airborne electrical noise. Turn off other equipment in the room (especially computer monitors). Do NOT clip transducers onto patient's clothing.	Check electrode impedance. The goal is to have all electrode impedance at or below 5 k Ohms and balanced (less than or equal to 3.0 k Ohms) impedance between electrodes. Tape or braid the electrodes to improve common mode rejection. Make sure that all electrodes are of the same metal type. Re-chloride electrodes, if necessary.
Environmental variables		
Temporarily disconnect patient from other equipment. Find a more electrically quiet place to test. If patient is on a chair or bed that is plugged into an electrical outlet, unplug it. Turn off other computer monitors or other sources of electromagnetic interference.	Place the electrodes in a glass of water and position the glass in the location where the patient's head is usually positioned. ◆ View the EEG signal and noise level. ◆ If electrical interference is evident, try moving the glass of water to a different location. ◆ If you find a quieter spot, reposition the patient's chair/bed to that location.	
60 (50) Hz interference		
Turn off fluorescent lights or lights with dimmer switches. Test the outlet to make sure it is grounded. In some cases it will be necessary to install a dedicated electrical outlet or shield the test environment.		

Post-Auricular Muscle Artifact (PAM)

What is PAM?

- ◆ A large peak in the response that occurs anywhere from 10-14 ms.
- ◆ Sound-evoked muscle compound action potential.
- ◆ Can change from run to run.

What are the sources of PAM?

- ◆ Muscle activity (movement of body parts, muscle tension, jaw movements, swallowing, coughing).

How does PAM affect Stacked ABR?

- ◆ PAM can change from run to run so the subtraction from the derived bands will not eliminate the effect of PAM.
- ◆ The peak latency can be anywhere from 10-14 ms so PAM can interfere with wave V in the lower high-pass conditions and derived waves.
- ◆ If the Click Alone or any of the high pass responses has PAM, the Stacked ABR will be unreliable and uninterpretable.

What can be done about PAM?

- ◆ Make sure patient is relaxed.
- ◆ Make sure patient's head and neck are supported to make the patient feel more comfortable.
- ◆ Remind patient to keep eyes closed, relax head and neck muscles, unclench jaw, and keep head centered.
- ◆ Make sure mastoid electrodes are not placed on muscle.

High or open impedance

Equipment variables

Make sure the patient cable is securely coupled to the NavPro box.

Prepare the electrode site again.

Exchange the electrodes between two inputs to see if the problem follows the electrode.

Try a different set of electrodes.

Check impedance with blue end of loop test cable attached.

Perform Self Diagnostic Procedure.

Environmental Noise Reduction Checklist

The Navigator Pro has been designed to reject noise thru artifact rejection. This checklist can assist you in identifying noise that may effect acquisition of AEP data.

1. Navigator Pro box should not be close to the isolation transformer.
2. Separate the patient cable from the transducer cable and from any power supplies and cables.
3. If possible, avoid clipping the transducer stimulus boxes to the patient. Clip to a pillowcase instead. Do not let the tubing of the transducers touch the electrodes.
4. Do not place the ground electrode close to the heart (front or back of the patient). Noise can be generated by a large EKG.
5. Turn off any unnecessary external computer monitors.
6. Turn off fluorescent light(s) or dimmer switches when operating the equipment. Do not have dimmer set in the middle position.
7. Turn off/Unplug any equipment in the same room as the system i.e. monitor, computer, typewriter, coffee pot etc. Of course, temporarily disabling medical monitoring equipment used on the patient must be performed by a qualified nurse or physician.
8. Only plug the Navigator Pro into the supplied isolation transformer. Do not use outlet strips or extension cords. Connect the isolation transformer directly to wall outlet.
9. If patient is lying on a chair that plugs in – unplug the chair. If patient is lying on a metal bed, do not have electrodes touching the metal of the bed.
10. Use a dedicated circuit (line) for the system (i.e. AEP system is only system in outlet.) Verify with an electrician or Bio-medical dept. If not using dedicated line – other office equipment (i.e. copier) can introduce noise.
11. Assure that your wall outlet is grounded and wired correctly. Verify with an electrician or Bio-medical dept.
12. Do you have a radio station transmission tower nearby? This will create noise.
13. Are there any large devices in adjacent rooms or adjacent floor (eg X-ray equip. MRI, refrigerators, air conditioner – window unit, elevator motors, etc.)
14. Do not use cellular phones when operating the equipment.
15. If 60 or 50 Hz noise is present (in most window sizes there will be only 1 or 2 cycles present), turn on the notch filter and see if the noise disappears. See Protocol – Amplifier Tab section.
16. Click on View EEG button on the collection screen. Place the electrodes into a cup of water and walk the cup of water and electrodes around the room to identify the noise source. Watch the EEG window, as you get closer to the noise source the EEG will become noisier.
17. If only artifact is being collected, turn off the artifact rejection so that data collection can occur. Collect the noise, so that you can fax it to Bio-logic to determine the frequency of the noise to assist you with troubleshooting.
18. Move the system to a different room away from the existing location. Move system to a different part of the building if noise cannot be resolved.

Calibration of Bio-logic Equipment

Bio-logic Systems Corp does not require, however, does recommend calibration of its equipment. Most equipment used to test hearing is calibrated on an annual or semi-annual basis. The calibration of equipment sold by Bio-logic Systems Corp must be performed by the factory or by an authorized Bio-logic representative. Likewise, the repair of Bio-logic equipment must be performed by the factory or by an authorized Bio-logic representative.

Please contact Bio-logic Hearing Technical Support at 1-800-272-8075 or 1-847-949-5200 for the name of your local Bio-logic representative.

Appendix A

Precautions and Safety Instructions



WARNING

Equipment that supports this program must be designed to meet all applicable medical equipment standards for patient isolation and electrical safety. Bio-logic Systems Corp assumes no responsibility for the equipment into which this program is installed, or for errors and omissions made during the installation process. It is the installer's responsibility to insure the finished system meets appropriate equipment standards, such as IEC 60601, BS 5724, and UL2601.

AVERTISSEMENT

Pour accueillir ce programme, le matériel doit être conçu de façon à satisfaire à toutes les normes applicables au matériel médical en matière d'isolation du patient et de sécurité sur l'électricité. Bio-logic Systems Corp. n'assume aucune responsabilité à l'égard du matériel accueillant le présent programme, ni des erreurs et omissions commises pendant l'installation. La responsabilité de s'assurer que le système complet satisfait aux normes applicables sur le matériel, notamment IEC 60601, BS 5724, et UL2601, appartient à l'installateur.

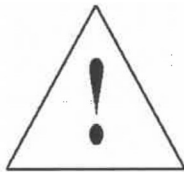


WARNING

Never place powered equipment (that is, equipment that operates with a electric power source) on any flammable surface. Avoid this whether the equipment is active or not.

AVERTISSEMENT

Ne jamais placer du matériel électrique, qu'il soit en marche ou non, sur une surface inflammable.



IMPORTANT

This device is intended for use by qualified personnel only. Please read this section and the remainder of the AEP System's User's Manual before installing any of the AEP System hardware, then retain this section as a reference while operating, transporting, storing or re-installing the AEP System equipment.

IMPORTANT

Ce dispositif ne doit être utilisé que par un personnel qualifié. Veuillez lire la présente section, ainsi que le reste du Guide d'utilisation du système AEP avant de commencer l'installation du matériel, puis conserver la présente section comme outil de référence pour le fonctionnement, le transport, le rangement ou la réinstallation du système AEP.

Equipment Identification Label and Markings

Classification

The International Electrotechnical Commission classifies electro-medical equipment according to its power source (external or internal) and the degree of protection it provided against shock. The AEP System is classified as Class II, Type BF, which means it qualifies as externally powered equipment capable of protecting a patient from electrical shock, provided electrical parts, such as electrodes, have been applied to the patient.

Warning Labels and Symbols

Symbols are often used on equipment in preference to words in order to simplify language differences and to provide instant comprehension of warnings and markings in a restricted space. The following symbols appear on AEP System equipment or in the AEP System User's Manual.



Attention, consult accompanying documents



Type BF equipment

Electrical Installation Requirements

All system equipment must be installed at a properly grounded site. This section gives detailed information on how to ensure the installation site meets all necessary requirements.

Grounding Requirements

The desired installation site must have a grounding wire for electrically connecting the system equipment to a properly grounded terminal (Earth). The grounded terminal shall be connected to the steel skeleton or under the main reinforcing steel with any multiple grounding wires grounded at the same point. (One point grounding.) The shield room or bed must also be grounded at the same grounding terminal as the installation site.

Power Plug Requirements

Use only the following power plug configurations.

- A 3-pin power plug requires a 3-pin wall socket with a properly installed grounding pole. Verify the wall receptacle is correctly grounded before inserting the 3-pin power plug.
- A 2-pin/3-pin adapter for connecting 3-pin power supply plugs into a 2-pin wall socket. The grounding terminal on the adapter must be fixed with the free end secured to the ground terminal.
- A 2-pin power plug with a grounding terminal for a 2-pin wall socket. The grounding terminal on the power plug must be secured to the ground terminal.

Types of Hospital Facility Groundings

Use the following information to verify the installation site has the appropriate grounding.

Grounding Resistance	The ground resistance of grounding poles connected to medical equipment must be 10 ohms or less.
Protective Grounding	Protective grounding must be provided for patient safety to let the leak current flow into the ground.
Functional Grounding	This type of grounding is not a requirement for patient safety, but will help to eliminate hums.

Hazards of Improper Electrical Installations

Improper electrical installations can cause electrical shock to either the patient or user. It can also damage system equipment under a fault condition. Ensure patient electrodes do NOT come into contact with any conductive material, including the grounded chassis of the computer.

Environmental Conditions

- Select a room with properly grounded power sources.
- Do not use or store AEP systems and equipment in places where chemicals are stored or where there is a potential for gas leakage.
- Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperature, poorly ventilated areas and dusty, saline or sulfuric air.
- Verify the selected site maintains a relative humidity between 25% and 95% (without condensation).
- Verify all conditions meet the requirements listed in the Environmental Specifications section of this manual.

Room Topography

- Place all equipment on an even, level surface. Avoid the potential for mechanical shock or possible vibrations during setup system operation or when relocating the equipment.
- Verify the iso-transformer and all portable multiple socket-outlets are off the floor and in a dry location.

Environmental Specifications

Temperature

Operating: 15 to 40° C

Storage and transportation: -20 to 70° C

Humidity

Operating: 15% to 95% at 40° C non-condensing

Storage and transportation: 90% at 65° C

Note: These are maximums. They are not "normal" operating or storage conditions.

Condensation

Recovery Time after condensation to operations specifications: 24 hours

Flammability

UL94 HB
UL94V-O

EMC Specifications

Cispr 11 B Conducted and Cispr 11 B Radiated Emissions
 EN61000-4-2 Electrostatic Discharge Test
 EN61000-4-3 Radiated Susceptibility Test
 EN61000-4-4 Transient Susceptibility Test
 EN61000-4-5 Surge Susceptibility Test
 EN61000-4-6 Conducted Immunity Tests
 EN61000-4-11 Voltage Fluctuations Test
 EN61000-3-2 & EN61000-3-3 Dips and Flicker Test
 RE 101 Magnetic Emissions Test

System Hookups



WARNING

Only use the Power Supply Model Number 520-PS12D3 or 520-PS6V4A (depending on NAVPRO model) with the AEP system.

AVERTISSEMENT

Utilisez seulement le bloc d'alimentation modèle numéro 520-PS12D3 ou 520-PS6V4A (selon le modèle NAVPRO) avec le système AEP.

- Verify the system computer power supply (if present) is plugged into either:
 —an iso-transformer from the 520-XFS family of iso-transformers
 OR
 —a 520-AMPS01 iso-transformer.
- Verify the maximum load for any multiple portable socket-outlet:
 —does not exceed 750 VA for the 520-XFS family of iso-transformers
 —does not exceed 100 VA for the 520-AMPS01
- Do NOT use the multiple socket-outlets to power any equipment that isn't a part of the AEP System. (Adding other equipment may increase the current amount of leakage and exceed the safety limit.)
- Do not interconnect multiple pieces of equipment without verifying that the sum of all leakage currents does not exceed the safety limit.
- Do not connect non-medical electrical equipment directly to a wall outlet if the AEP System is using a multiple, portable socket-outlet with a separating iso-transformer. (The additional equipment may increase the current amount of leakage and exceed the safety limit.)
- Do not connect equipment, which can potentially provide electromagnetic or other types of interference. This may cause the AEP System equipment to function incorrectly.
- Verify the equipment is connected to a power line source with the following frequency, voltage and current capacity.

Frequency:	50 / 60 Hz
Voltage:	100 – 240 VAC
Current Capacity:	15 Amps min.

- Use only Ink Jet printers for AEP System setups that use the AEP System isolation transformer.

Installation Verification

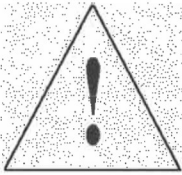
Use the following to verify all equipment is correctly installed before use.

- Verify all equipment and cables are undamaged and in good working condition.
- Verify all equipment and cables are connected according to the instructions in this manual.
- Verify unauthorized equipment is not connected to the system.
- Verify the equipment is properly grounded.
- Verify all circuitry with a direct connection to the patient has been checked twice.
- Verify all system or equipment batteries show the correct voltage and are in perfect working condition.

System Diagnostic and Verification Tests

Before connecting the patient to the system equipment, perform all required system diagnostic tests described in the AEP System User's and Service Manuals. All tests must pass.

Precautions During System Operation

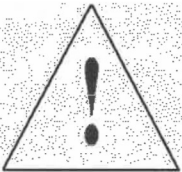


WARNING

Never turn power on or off with a patient connected to the system. Only qualified personnel should use this device. Please read this section before installing any of the hardware. Refer to this section when you operate, transport, store, or re-install the system.

AVERTISSEMENT

Ne jamais mettre le système sous tension ou hors tension pendant qu'un patient y est branché. Ce dispositif ne doit être utilisé que par un personnel qualifié. Veuillez lire la présente section avant de commencer l'installation du matériel. Consulter la présente section pour des informations sur le fonctionnement, le transport, le rangement ou la réinstallation du système.



WARNING

All of the disposable supplies from Bio-logic Systems Corp that are coupled to the scalp are latex-free and comprised of hypoallergenic material. Bio-logic is not responsible for disposable items purchased from another vendor. Carefully read and follow the proper use instructions that accompany any disposable items.

AVERTISSEMENT

Tous les produits jetables destinés à entrer en contact avec le cuir chevelu fournis par Bio-logic Systems Corp. sont fabriqués de matières hypoallergéniques et ne contiennent pas de latex. Bio-logic n'assume aucune responsabilité à l'égard des articles jetables achetés d'un autre fournisseur. Lire et appliquer minutieusement les directives d'utilisation correcte qui accompagnent tout produit jetable.



WARNING

Make sure that any platform, table, cart, or other surface used during the operation, transport, or temporary or permanent storage of the system and its components is adequate, sturdy, and safe. Bio-logic Systems Corp is not responsible for any injury or damage that may result from inadequate, poorly constructed, or unapproved transports, carts, operating surfaces

AVERTISSEMENT

Veiller à ce que toute surface utilisée pour le fonctionnement, le transport ou le rangement temporaire ou permanent du système ou de ses composants, notamment toute plateforme, toute table ou tout chariot, soit de dimensions suffisantes, robuste et sans danger. Bio-logic Systems Corp. n'assume aucune responsabilité à l'égard des blessures ou dégâts découlant de l'utilisation de dispositifs de transport, de chariots ou de surfaces d'opération inappropriés, mal construits ou non homologués.



WARNING

Never use equipment that has parts missing or equipment that might contain loose parts inside of it (that is, inside an enclosed portion of the equipment). If you suspect a piece of equipment has missing or loose parts, make contact with Bio-logic System Corp.

AVERTISSEMENT

Ne jamais utiliser le matériel s'il manque de pièces ou s'il contient (dans une de ses structures fermées) des pièces desserrées. Si vous avez des raisons de croire à l'existence de pièces manquantes ou desserrées dans une des composantes du matériel, communiquez avec Bio-logic Systems Corp.



WARNING

Never place powered equipment (that is, equipment that operates with an electric power source) on any flammable surface. Avoid this whether the equipment is active or not.

AVERTISSEMENT

Ne jamais placer du matériel électrique, qu'il soit en marche ou non, sur une surface inflammable.



WARNING

This equipment is not protected from a cardiac defibrillator discharge. Using a defibrillator while a patient is connected to the system equipment may permanently damage the equipment.

AVERTISSEMENT

Cet équipement n'est pas protégé contre les décharges électriques de défibrillateur cardiaque { «défibrillateur» xe}. Utiliser un défibrillateur alors que le patient est raccordé au système peut endommager définitivement l'équipement.

1. Follow all safety procedures, giving careful and constant attention to the patient and system equipment.
2. Follow hospital procedures to validate all electrodes are properly applied in order to prevent patient burns while using electro-surgical equipment.
3. Turn the system power on BEFORE you attach electrodes to the patient. Remove the electrodes from the patient BEFORE you turn the system power off. This avoids shock hazards from power surges.
4. Attach electrodes to the patient and the system hardware so that the electrode cables can neither entangle nor strangle the patient.

5. Avoid direct contact between the patient and system equipment at all times.
6. Do not add other equipment that is not protected against ingress of liquids.
7. This equipment is not suitable for use in areas of flammable or anesthetic mixture.

Signal Output and Input

The system computer must NOT be used in a patient environment unless one of the following conditions are met:

1. The system computer and all other peripheral devices are plugged into the isolation transformer.
2. The portable computer is powered by batteries. It does not plug into a wall outlet. No AC-powered peripherals except the AEP System module (NAVPRO) connect to the portable computer.
3. The system computer has an isolated power supply.

Care and Maintenance

This section gives users information on maintaining and caring for AEP System.

Cleaning

No special cleaning is required for this device. Ordinary, 'house-keeping' type cleaning to prevent the accumulation of dust or debris is adequate.

Inspection

No special inspection procedures are required for this device.

Disassembly and Storage

The AEP System equipment requires careful handling during disassembly and storage.

1. Return all controls to their original positions and turn OFF all system equipment.
2. Carefully remove all connecting cables without using force.
3. Follow designated hospital procedures to clean AEP System equipment.

Maintenance

AEP System equipment requires professional maintenance and repair service. Never attempt to alter, modify or repair this equipment on your own.

1. If the AEP System equipment is not functioning correctly, mark all defective parts clearly to prevent accidental use before the appropriate repairs can be made.
2. When using a defibrillator, either protect the equipment against defibrillator discharge or remove all patient cables and/or transducers to avoid system damage.

Appendix B

Electrical Requirements

Use the following requirements to avoid noise interference while recording activity from patients and to ensure a consistent electrical environment for the computer system.



WARNING

Never turn power on or off with a patient connected to the system. Only qualified personnel should use this device. Please read this section before installing any of the hardware. Refer to this section when you operate, transport, store, or re-install the system.

AVERTISSEMENT

Ne jamais mettre le système sous tension ou hors tension pendant qu'un patient y est branché. Ce dispositif ne doit être utilisé que par un personnel qualifié. Veuillez lire la présente section avant de commencer l'installation du matériel. Consulter la présente section pour des informations sur le fonctionnement, le transport, le rangement ou la réinstallation du système.



WARNING

Never place powered equipment (that is, equipment that operates with an electric power source) on any flammable surface. Avoid this whether the equipment is active or not.

AVERTISSEMENT

Ne jamais placer du matériel électrique, qu'il soit en marche ou non, sur une surface inflammable.

Isolated or non-isolated power

Although AEP Systems will function with non-isolated power, Bio-logic prefers isolated power for maximum efficiency and safety.

15 or 20 amps

Although 15 amps is acceptable in smaller systems, a 20-amp service is preferable anytime the system in use has a large amount of features.

BTU Offset

Bio-logic Systems Corp computer systems release a maximum of 2000 BTU per hour.

Magnetic Field

Bio-logic computer systems should operate without any interference in a magnetic field of 0.05 Gauss.

Room Shielding

Although Bio-logic recommends room shielding, it is not absolutely required. Users may elect to shield the room if the location is close to noise-generating equipment and should provide shielding if there are potential noise level problems.

Fluorescent Lights

Although the AEP System works in a room with fluorescent lighting, incandescent lighting is preferred. Also, dimmer switches can produce noise interference unless the switch is set at a full position.

Thickness of the Conduit

The thickness of the conduit and all electrical installations must meet the National Electrical Code and applicable local codes.

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